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"If there were a digital version of Bullshit Bingo, most people would have the word 'utility' on the top row" - Tracey Follows

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PHOTOGRAPHY: EVAN KAFKA

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Right: electrical and biomedical engineer Nina Tandon



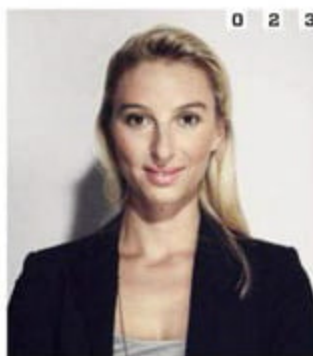
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TOM FORD NOIR

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RANTS



CENTENARY ALE

On my way to see the @WiredUK 100th podcast episode being recorded and partake of the awesome-sounding Swiggs Boson. For science. @TinyMaster



WIRED TWEETS

Loving this month's cover of @WiredUK - Go Uncle Bryn! @wynneraymond

d have liked to be in the @WiredUK meeting where they decided to put @RobBrydon in jet pack on the cover. @acton

It's still acceptable for adults to ask for toys for Christmas, right? Because I've just seen the ArcBotics Hexy in @WiredUK and... DO WANT. @tsuki_chama

In this month's @WiredUK: refighter helmet with a thermal imaging camera. Mmmm, I reckon everything they see will be really, really hot. @joe_stone

THE HITS PARADE

The three most-read stories on wired.co.uk last month: Netherlands highways will glow in the dark from mid-2013 Assisted suicide legality does not increase patient death wish A holiday message from Ricky Gervais: "Why I'm a good Christian"

GAMER VS GAMER

Argue as much as you like, (Android is a desolate wasteland when it comes to games, wired.co.uk), but Android is not where game producers go to first. What is interesting is why that should be. iOS is not an ideal platform - I would prefer to code for Android. Why, then, would I release first with Apple? In spite of the cut they take? Welcome to multi-sided markets, the benefits and tyrannies of the walled garden etc. Bryan Smith, via wired.co.uk

12.12 The 2013 Gear Guide: Last month, actor and PC-hacker Rob Brydon flew to WIRED Towers by jet pack to introduce our annual guide to must-have tech, toys and devices. We hope its contents don't break the bank for you in the run-up to Christmas. If not, there's always our *Sound and Vision* supplement... Let us know if we missed anything off your wish-list. Email us: rants@wired.co.uk

PRIVACY UPDATE 1

Your article (Privacy versus Facebook, 12.12) only talks about the data Facebook collects from "objective" sources (such as geotags, friends or things you have "liked"). It also deduces a lot more about users; I know many people who have never directly "told" Facebook they are gay in their profile data but who nonetheless are served with adverts for gay dating adjacent to their newsfeed. The imputed data and the deductions Facebook and

other such companies make are more interesting (or sensitive) than the objective facts they collect about us. Dr Tom Dolphin, chairman of the BMA Junior Doctors Committee, via email



PRIVACY UPDATE 2

When will people realise that technology is making us the slaves of corporations and government (Microsoft files for living-room snooping patent, wired.co.uk)? Every day another piece of privacy is chipped away. Apple has a patent that allows it to remotely switch off your iPhone if you enter certain areas. The city of Baltimore is installing microphones in buses. We need an anti-surveillance movement as strong as Occupy. Mike P, via wired.co.uk



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Danielle Rago

Native New Yorker Rago reports on the latest addition to the Louvre in Paris – its new Islamic art gallery, which resembles a fluttering flying carpet. "It's an elegant solution, and I don't think it will divide opinions the way the glass pyramid first did," says Rago. "On the whole, people are more open to innovative architecture now."



Alexander Babic

Babic paid a visit to the fictional Soviet microstate of Unterzögersdorf (it's on the Austrian border, in case you were wondering), to photograph some of its revolutionary residents – an art collective known as Monochrom. "All the people involved stayed completely in character," he says. "Artists have to be a little bit crazy."



Julia Hobsbawm

In Ideas Bank this month, Hobsbawm calls for open-source elitism in education. "I'm fascinated by how people connect to each other and learn at the same time," she says. "The only way to do this in today's era of total overload is by the knowledge networking process: learning a little about a lot, in small, curated environments."



James Dawe

Dawe kicks off our feature on the UK's special-effects scene with an illustration comprising some of film and TV's greatest CGI hits. "I'm easily swayed by special effects," says Dawe. "Especially classic explosions – atomic ones that result in big mushroom clouds, or billowing flames and flying debris." Best hide the fireworks, then...



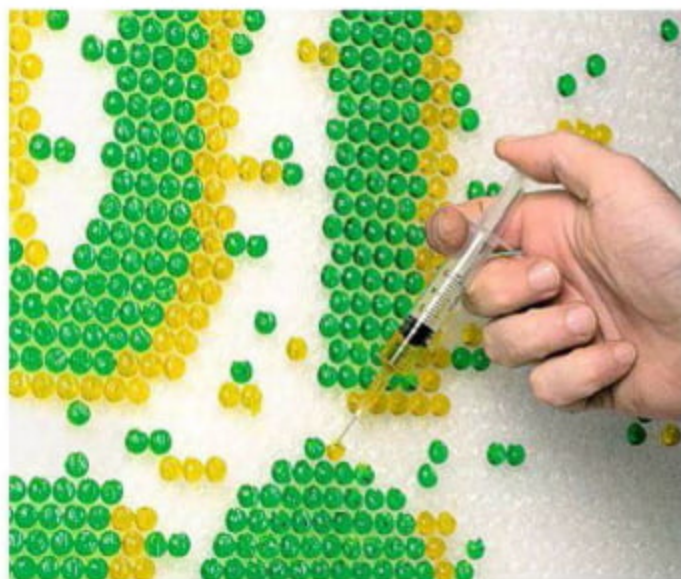
Alicja Pytlewska

To better illustrate Bare Conductive's amazing electricity-conducting paint, we asked artist Pytlewska to create a backdrop that could double as an interactive surface. "I wanted to tell the story of what the paint is capable of, using simple icons," says Pytlewska. You can see more of her work with the conductive paint by visiting studiolalka.me

Making WIRED

Injectable artwork

Jana Rey (project manager, Lo Siento Studio), features opener, p103: "We'd injected dye into bubble wrap before, but not on such a large scale, so it was a bit of an experiment. One version got destroyed when it was blown over, and we managed to get colour on the studio walls as well. Someone did get jabbed with a needle, but it wasn't too bad. It was a challenge – and we had a lot of fun."



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Meeting the WIRED crowd

Dan Burn-Forti, WIRED2012 report, p55: "Spending two days shooting this assortment of 21st-century technotitans was quite intense. Although often reluctant to have their photograph taken (no one likes photographers), they were all accommodating and, ultimately, did as they were told. I've definitely never bossed so many people around in such a short space. I admit, I liked that bit."

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FROM THE EDITOR

For a couple of intense days at the end of October, we brought together more than 50 of WIRED's favourite speakers to share their stories and inspiration at our second annual London conference. It was a phenomenal if eclectic mix: activists and artists, designers and data gurus, social entrepreneurs and a superchef – from as far afield as Bangalore and Brooklyn. Yet we didn't want to limit their impact to the 561 delegates in the room. So this month, we've included a flavour of WIRED2012 in an eight-page special report. You can read about the extraordinary ambition of designer Thomas Heatherwick, as well as the transformative science of MIT's vision specialist Ramesh Raskar. We've revisited the determination of Ferran Adrià, the famous chef at elBulli (and our 10.12 cover star), to empower a spirit of culinary innovation; reported how computer-security expert Keren Elazari hacked the audience's phones in real time; and channelled the energy of the talks by Mark Pollock, who is training to overcome paralysis and learn to run again; and Mona Eltahawy, whose life was saved by Twitter when she was captured by police in the Cairo uprising.

PHOTOGRAPHY: LEON CSENOHLAVSKY



But eight pages hardly do justice to a packed schedule. We had no space to cover the enormously moving talks by charity:water's Scott Harrison and Embrace's Jane Chen; the guest sessions curated by Maria Popova and Scott Belsky; the Wayra startup competition run by our event partner Telefónica. Nor did we get to tell you about the powerful talks by Lily Cole, Troy Carter (*top-right, with WIRED executive editor Greg Williams*) and David Karp – or the performances by musical supertalents Gotye and Imogen Heap. That's why we're rolling out HD video of almost every WIRED2012 talk at wired.co.uk/12, where you can also read event coverage and enjoy our special podcast. I feel privileged to have been part of an event which brought together so many fantastic speakers and engaged delegates. Thanks to all of you – join us again for WIRED2013 next October...

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Download the app to get inside WIRED2012, with videos of speakers such as Troy Carter and Ferran Adrià.



Listen to an interview with the founder of king.com, Riccardo Zacconi, as he discusses the future of gaming.



Watch the trailer for a new film by the radical Soviet revolutionaries of the Monochrom art collective.



David Rowan, Editor

David Rowan

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- D&AD Award: Covers 2012
- DMA Editor of the Year 2011
- DMA Magazine of the Year 2011
- DMA Technology Magazine of the Year 2011
- BSME Art Director of the Year, Consumer 2011
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- D&AD Award: Cover 2010
- Muggies Technology Cover 2010
- PPA Designer of the Year, Consumer 2010
- BSME Launch of the Year 2009



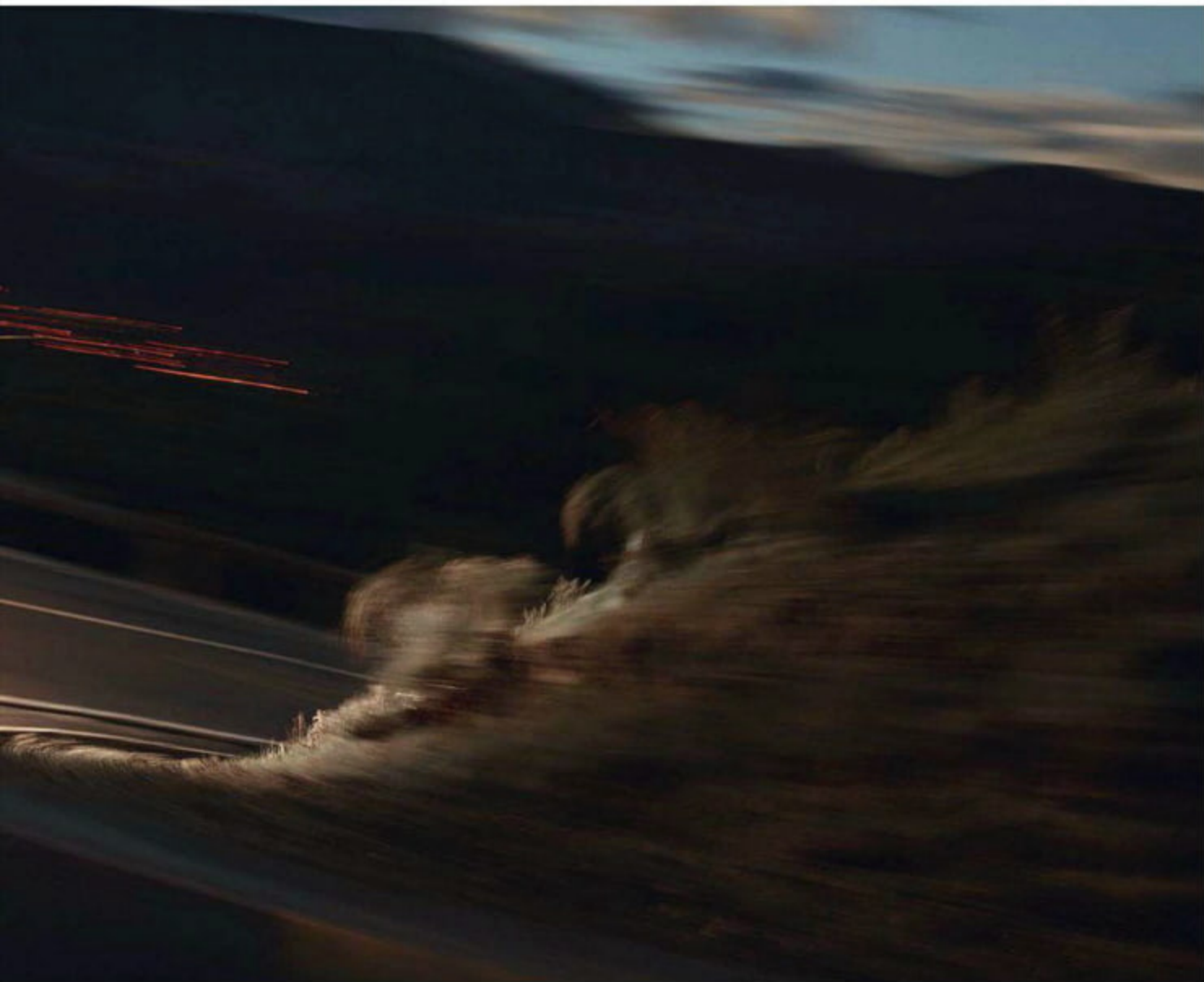
Two impressive red lines.

The new 911 Carrera models.

The redline of a Porsche 911 has always been impressive. For almost 50 years now, each new generation has pushed the boundaries of performance further and further. The new 911 Carrera 4 models are no exception. As well as their legendary all-wheel drive handling, they feature broad shoulders, making for a striking presence.

And the iconic red LED light strip across the rear, means other road users can now appreciate the red line of a 911 too.

To find out more visit www.porsche.co.uk/redlines



Model shown is a Carrera 4S Coupe at £88,774.00 including first year road fund licence and first registration fee. Fuel consumption figures for the new 911 Carrera 4S Coupe in mpg (l/100km): Urban 19.9 (14.2); Extra Urban 37.7 (7.5); Combined 28.5 (9.9). CO₂ emissions (g/km) 234.



PORSCHE

START

A large, complex scientific instrument, likely a particle accelerator component, is shown in a laboratory setting. The structure is composed of various materials, including blue and yellow painted metal beams, and a large red circular opening. The background shows a multi-story building with windows and a clear sky.

NEWS AND OBSESSIONS

THIS MONTH: 01.13

- DELTAWING RACE CAR
- ELECTRIC BIOLOGY
- MOBILE-PHONE DATA TRAILS
- SOLAR PAVILION

EDITED BY
JOÃO MEDEIROS



Cosmic camera

To take photos of distant galaxies, scientists had to build a super-high-resolution snapper

At 570-megapixel resolution, this camera can image galaxies up to eight billion light years away and capture light from 4,000 distant supernovae exploding in the night sky. "We want to probe the mystery of dark energy, the force we believe is causing the universe to expand faster," says Joshua Frieman, astrophysicist and director of the project at the US Department of Energy's Fermi National Accelerator Laboratory in Illinois. The camera has been mounted on a telescope at the Cerro Tololo Inter-American

Observatory in Chile and was due to start collecting data at the beginning of December. The device (suspended in the yellow ring) is roughly the size of a Smart car and weighs 5.4 tonnes; it uses an array of 62 charge-coupled devices (CCDs – like those in your phone camera), each measuring 2,000 by 4,000 pixels. Any day now, 200 scientists will start analysing the first images. "It will be a major step in helping us learn about the cosmic future of the universe," says Frieman. Get ready for your close-up, galaxies. mv.fnal.gov

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The signal engineer for hearts

Nina Tandon is shocking cultivated cells into life - offering the chance of growing new organs

Nina Tandon uses electricity to get living cells to do useful things. "Our bodies are electrical beings," says the electrical and biomedical engineer at Columbia University's Laboratory for Stem Cells and Tissue Engineering in New York. "One of the first things that happens in a developing embryo is that electrical currents start flowing. The signals tell the cells where to go, how to differentiate - if you reverse them, you can get the heart on the right, or flip the liver around. I want to harness that fact and get cells to do other things."

Tandon's primary work is with neonatal heart cells, which can be made to link up with each other and beat independently once exposed to pulses of electricity, as with a pacemaker. "We cultivate cells in advanced culture systems called bioreactors, which are like petri dishes outfitted with electrodes and pumps, then expose them to a short burst of electricity between one and ten V/cm - about three hertz for rat cells and one for human," she says. "Eventually they start beating together by themselves."

Tandon, 33, began her career as an electrical engineer working in telecommunications. But, while taking an evening class in physiology at a community college in New Jersey, she started to see parallels between electrical engineering and the body. "I looked at DNA and thought: 'hard drive'. I found the equations governing the transmission of signals along nerves were the same ones developed for transatlantic cables. I applied to grad school and made a shift into biology. I did electrical

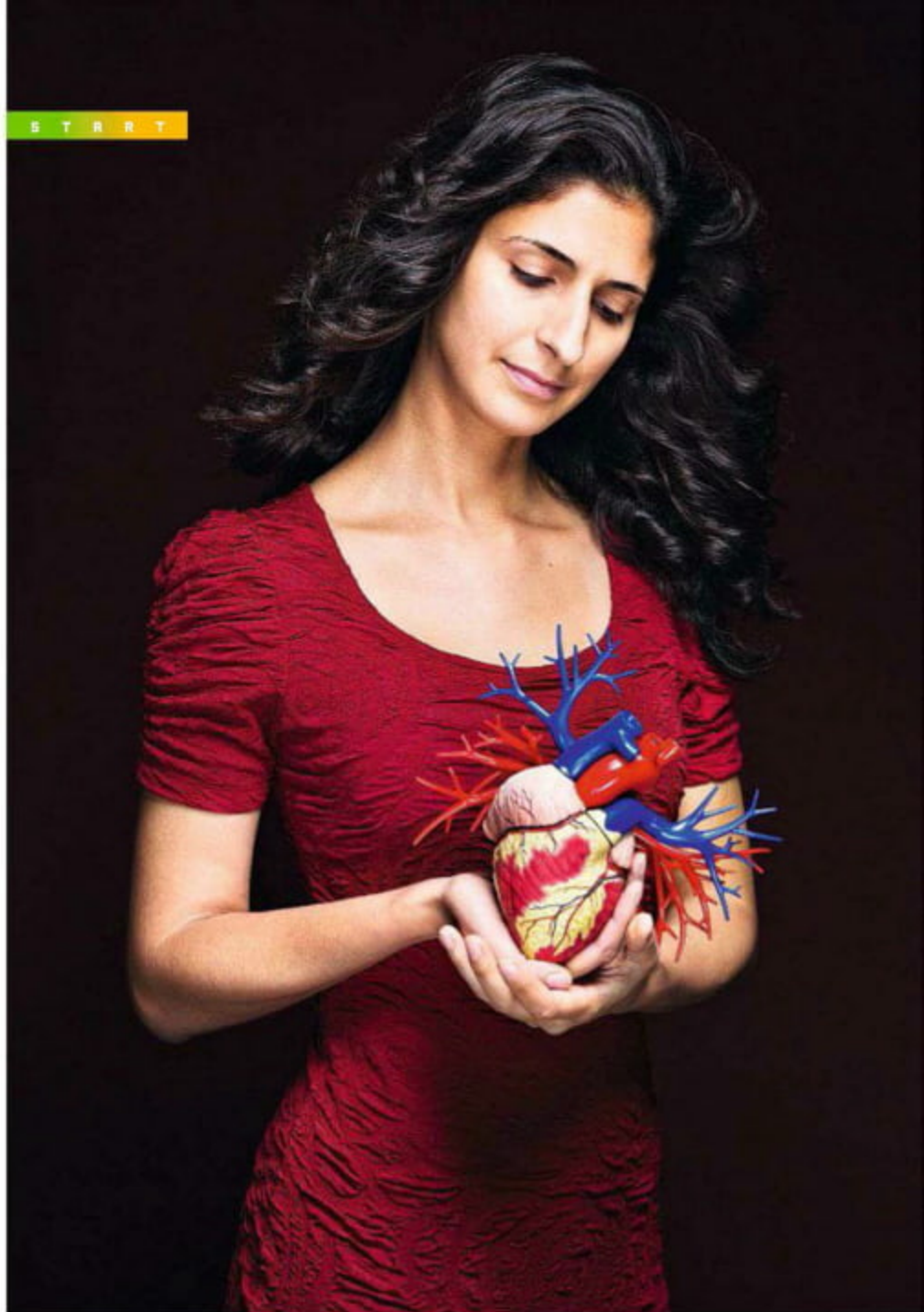
engineering at MIT, then bioelectrical at MIT, then biomedical at Columbia."

New Yorker Tandon (pictured) is a 2011 TED Fellow

In the long term, the work Tandon and her colleagues are doing could accelerate our ability to grow organs for transplant. "This will happen," she says, "but it will take a long time, maybe 15 to 30 years for an organ like a heart, perhaps ten years for bone." In the meantime, she is working on producing miniaturised tissues, such as a 3mm heart.

"We could make 1,000 miniature human hearts for use in pharmaceutical trials," she says. "This would give much more useable results than animal tests - and save a lot of laboratory mice." David Baker ninatandon.com

A 5mm x 5mm piece of engineered - and beating - cardiac tissue cultured by Tandon, a result of five days of electrical stimulation





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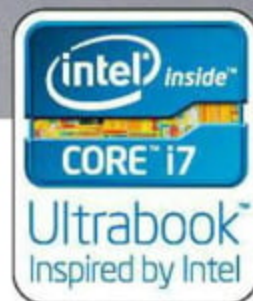


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Sofie Qidenus uses robots to build digital libraries. "I knew nothing about robotics when I started, but I felt that there would be a huge demand for book digitisation," the Austrian entrepreneur (right) says. Her robot scanners have helped to digitise 80 per cent of all European national-library books. Her next chapter: the ScanGuru, a book-scanner that allows home users to turn books into ebooks.

Vienna-based Qidenus founded her company in June 2004. Her first design was a robotic finger to flip sheet-music pages so performing musicians could keep their hands on their instruments. "Turning pages is the major bottleneck for book digitisation," says Qidenus, 30. "So we started

building a robot to make ebooks." Qidenus Technology now sells a dozen models – shown below is the RBS Full, which costs from €70,000 (£50,000). The book rests in a cradle and the glass "V" descends to flatten the pages, which are photographed by two cameras and digitised. The "V" then ascends, and the robot finger turns the page. It can digitise up to 3,000 pages per hour at 500dpi resolution.

Qidenus counts the Google Book Project, the Library of Alexandria in Egypt and several national libraries in Europe among its clients, and it has received €1 million from Austrian investors. The next step is to bring the technology to the masses. "The ScanGuru will be smart, but very simple," says Qidenus. "We want people to use it at home." **MV** qidenus.com



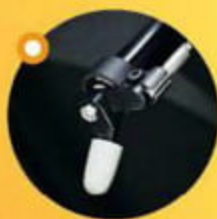
A Viennese page-turner

Bookworms rejoice! You no longer have to be a national institution to create your own custom e-library



Tablet extra!
Download the WIRED app to watch the book scanner in action

S T A R T



● A camera on the right captures the left-hand page; the left camera photographs the right

● A sensor modifies the finger pressure for various book types and paper qualities



ASUS recommends Windows 8.

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* External wired subwoofer and touchscreen are available on selected models only.

Friending your stuff

Are your fridge, car and tennis racquet managing their own social-media presence yet? It's only a matter of time, says EVERYTHING

London- and Zurich-based year-old startup EVERYTHING is building a social network for everyday objects. "Our idea was: what if every object had its own presence on the net, so you could talk to it?" says Andy Hobsbawm, the company's cofounder and CMO. "We call it 'a Facebook of things'." Once an object has a digital profile, developers build apps that allow its owner to amass data about it.

The technology uses manufacturer's identifiers, such as barcodes, QR codes and RFID chips, to connect objects to a database. Scanning an object's tag with a smartphone activates its digital identity. In a pilot for Father's Day in Brazil, alcoholic-beverage giant Diageo connected whisky bottles to the EVERYTHING database. People could buy a bottle for their dads and activate its digital identity with a smartphone, launching a web app. "Then, when your dad scans it, the video tribute pops up on his phone. You've attached a piece of personalised content to travel with that bottle," Hobsbawm says.

Along with cofounders Dom Guinard, 31, Niall Murphy, 43 (who also cofounded Wi-Fi company The Cloud, which sold to Sky in 2011), and Vlad Trifa, 32, Hobsbawm has built a database to store "thngs": digital identities that collect textual, binary and geolocation information. The database stores 200,000 identities and the company plans to manage a billion within the next three years. The software

also has a set of APIs, to enable apps for user-generated product personalisation (as Diageo is doing), customer-loyalty rewards and data-tracking for retailers.

EVERYTHING has funding worth \$1m (£600,000) from Niklas Zennström's Atomico, among others, and is partnering with ARM to produce an embedded-sensor system that will be implanted in cars, toys and other objects. "This isn't about getting machines to talk to each other," Hobsbawm, 49, says. "It's about connecting owners to their products, so they can respond dynamically to real-time data." MV.evrythng.com



Tablet extra!
Download the WIRED app to listen to an EVERYTHING interview



Connected: EVERYTHING's Dom Guinard, Niall Murphy, Andy Hobsbawm and Vlad Trifa

WIRED

Winter storm Draco

Die Hard comeback

Stuff on Elle's Head

XOXO

Cinema ninjas

TIRED

Hurricane Sandy

Schwarzenegger comeback

Cat with pancake

SXSW

Copyright stream filters

EXPIRED

The Great Storm of 1987

Stallone comeback

Oolong the rabbit

Burning Man

FACT trailers

Reasons to be cheerful.



No. 26

A Samsung GALAXY Note II under the tree.

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Every finger has four joints and three degrees of freedom

Each arm has 41 torque sensors to provide feedback to the operator

S T A R T

Suspension-locking devices stiffen the upper body during tasks

Hands in space

Even from 40,000km away, Justin, a remotely controlled humanoid, lets you sense what it touches

This is Justin, a humanoid robot that can be controlled in space by a human on Earth. "Telepresence means you get the feeling of being there, even if you cannot go there," says Gerd Hirzinger, adviser at the Institute of Robotics and Mechatronics at DLR, the German Aerospace Centre in Cologne. In 1993, Hirzinger was in charge of the ROTEX experiment, involving the first

remotely controlled robot in space. "For seven years the joints on Justin were outside the International Space Station, where they worked perfectly," says Hirzinger. "I'm confident Justin could work on the Moon."

Developed at DLR, Justin can be controlled from 40,000km away, with only a 600-millisecond time delay. He has two dextrous hands on arms that mimic the motion of an exoskeleton-like "diver's suit" and provide force feedback, so the operator can feel what the robot feels.

Hirzinger says robots are already useful: "We do not need to wait until they are fully intelligent to send them into space - we're at the stage where we can control their movement from the ground." **Dan Cossins**

Smart solar structures

Architect Rodrigo Rubio let the Sun's path dictate his form-follows-energy remit

Architecture is a slow technology," says Rodrigo Rubio, architect at Barcelona's Institute for Advanced Architecture of Catalonia. "Maybe we have to rethink how we understand architecture – as a static field or a dynamic one." Rubio's Endesa Pavilion (*below*), a building shaped to maximise its exposure to the Sun, is, he says, a statement of how energy efficiency should guide the form of a building, rather than just adding solar panels to a finished design.

Every aspect of the pavilion design is shaped for its location on Barcelona's Olympic harbour. "Each module is adapted to its specific position in relation to the Sun's path," explains Rubio, 34. The angular modules reduce the Sun's full glare to the building's interior in summer, but let in light during winter. At the same time, the



endesa

arquitecto
rubio

solar panels are exposed as directly to the Sun as possible throughout the day and over the year. Designating the modules' positions involved feeding radiation, temperature and energy data into a software model – each panel is positioned at the sweet spot that maximises solar-panel surface area and exposure.

"We're balancing the production of energy with low consumption," says Rubio. "Our philosophy was, if you want to be self-sufficient, start by consuming less. Introduce the passive concepts, then the active ones." The pavilion is a proof-of-concept showroom that will remain on site for the next year as part of the Smart City Expo, and is intended to more than cover its own energy needs (using 20kWh per day, but generating 120kWh), selling the surplus back to the grid.

Rubio favours open-sourcing the software to allow anyone to build their own house, which can be customised for their location's climate. With design, fabrication and construction costs kept low, and a surplus of solar energy being produced, owners of these buildings may find they pay for themselves. Meanwhile, Rubio is thinking of taking his form-follows-energy concept further, "to make it more high-tech and more reactive to the environment," he suggests. "Instead of static models optimised for position, we'll make a dynamic façade that reacts to the position of the Sun in real time." **Jeremy Kingsley iaac.net**

PHOTOGRAPHY: ADRIA GOULA



Shown is the south side, which is open, but shaded. The north side is more closed to reduce heat loss

The building's wooden components were prefabricated in a factory to reduce waste. On-site, they were then assembled from the coded pieces

START

A SCREENED MAP APPS



Waze

The wisdom of the crowds is strong in this one. Waze pools experiences of drivers in your area, rerouting you in the event of congestion on your daily commute. *iOS, Android, BlackBerry, Windows; Free waze.com*



Bing Get Me There

Bing Get Me There combines maps with live updates on the status of London's public transport to offer a far more sophisticated way of planning your journey around the capital. *iOS, Windows; Free microsoft.com*



Nokia Maps

Although this is a web app, its functionality is so good, it performs like a native application. Nokia's maps work on pretty much any smartphone or computer. *iOS, Android, BlackBerry, Windows Phone; Free maps.nokia.com*



ForeverMap

ForeverMap pulls OpenStreetMap's crowdsourced maps into an easy-to-use utility, effectively letting the local cartographers who produced them guide you around the country. *iOS, Android; Free skobbler.com*



MapsWithMe Pro

An extremely good map application is rendered useless if you need 3G or Wi-Fi when you're in the middle of nowhere. This app lets you cache the maps you need for handy offline access. *iOS, Android; £2.99 mapswithme.com*



Plane Finder AR

It won't take you anywhere but it'll show you where others are going. Point your Apple iOS device at a plane flying overhead and discover its destination. Useless, yes. Entertaining? Totally. *iOS; £1.99 planefinder.net Nate Lanxon*

Britain's social king

Riccardo Zacconi has built an empire on Facebook-based games – and it's levelling up



Riccardo Zacconi has a lot to thank Facebook for: through the site, six of his firm's casual games are played three billion times a month, by 12m people. His London-based firm, King.com, is Facebook's number-two games developer worldwide, after Zynga. Now it's targeting the 78m users accessing Facebook via smartphone.

King.com was founded in 2003 as an online games company. "We used to distribute games through our website and large portals such as Yahoo!, NBC or CBS," says Zacconi, 45, CEO and cofounder. "In 2009, we noticed traffic moving towards Facebook," he says. At that point, the startup had about 11 million monthly players on its website. So the team picked its most popular web game, *Bubble Saga*, modified it using Facebook's social tools, and launched it on the social network in April 2011. Its Facebook games went from 0 to 50 million active monthly users within 15 months.

The team now uses its website as a testing ground for Facebook. It tests around 15 games a year. If one takes off, it gets adapted for Facebook. Revenue is generated through paying for extra lives, each of which costs, on average, 69p. Although profitable since 2005, the business recently received €34 million (£27m) from Apax Partners and Index Ventures, "But we haven't touched a penny of it yet," says Zacconi.

The next goal is to make King.com seamless across multiple platforms. "It's been a very positive synergy," Zacconi says of Facebook. "But now we want to be drivers of change."

MV.king.com

START

PHOTOGRAPHY: DAN BURTON-FORTI. ILLUSTRATION: PHIL WINGGLESWORTH

Down the hatch: the odd science of foreign bodies

The College of Physicians at Philadelphia's Mutter Museum preserves medical oddities such as a 2.4m-long colon, abnormal fetuses and a few misshapen cysts and skeletons, all displayed behind glass. One cabinet, however, is filled with more than 2,000 everyday objects such as safety pins, pennies, buttons, charms, a padlock and a porcelain doll. These objects were found inside patients' lungs and digestive tubes by laryngologist Dr Chevalier Jackson, whose work was recently memorialised in the book *Swallow: Foreign Bodies, Their Ingestion, Inspiration, and the Curious Doctor Who Extracted Them*, by Mary Cappello. We've removed a few highlights from the collection. MV



914

Undated

A pair of toy **OPERA GLASSES** in the oesophagus of a four-year old girl. The child was given no anaesthetic and the object was removed in 45 seconds, using a speculum and forceps.



689

February 28, 1919

A **TOY DOG** in the oesophagus of Annie Z, age three. The metal animal was lodged in the girl's gullet for eight days and took just under five minutes to remove.



572

September 25, 1916

The cap from a **BRASS BEDSTEAD** in the right lung of nine-year-old Rudolph Hellman. The cap had been lodged in his lung for two years and took 17 minutes to extract.



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power to you



Is it a blimp? Is it a plane? Or is it both? The Aeroscraft ML868 is designed to carry 66 tonnes, fly at 220kph and land without using runways or external ballasting systems. Mansoor Kouchak, vice-president of engineering at Worldwide Aeros Corp, which

is building the vessel, says: "It'll fill the gap between what planes and helicopters do. It can land in areas without roads or infrastructure and carry loads that a helicopter never could." A half-sized 80m x 29m x 14m prototype (*below*) will be completed soon. "We plan to start engineering the Aeroscraft early in 2013 and finish in 2016," says Kouchak.

The distinctive engineering feature of the Aeroscraft is its helium-ballasting management system. "We can control how heavy or light the vehicle is by compressing

Blimps retake the sky

Using a million cubic metres of helium, a new dirigible can out-lift a helicopter, take off from the sea and help in fire-fighting

A rigid form and an internal carbon-composite frame helps with lift and keeps it streamlined

and releasing stored helium." About 1.3 million cubic metres of gas supports the craft, which is driven by propellers and six turbofan jet engines. It can land and take off vertically from any surface, including water and snow. "We have a unique landing system with suction capability, like a hovercraft's," says Kouchak, 50.

The Californian company received \$50 million (£38 million) from the US Department of Defense to build the prototype. Kouchak says the finished craft could be used to transport cargo to military bases, help out in natural-disaster-hit areas or assist in firefighting. "It will pretty much change the concept of flying." MV.aeroscraft.com

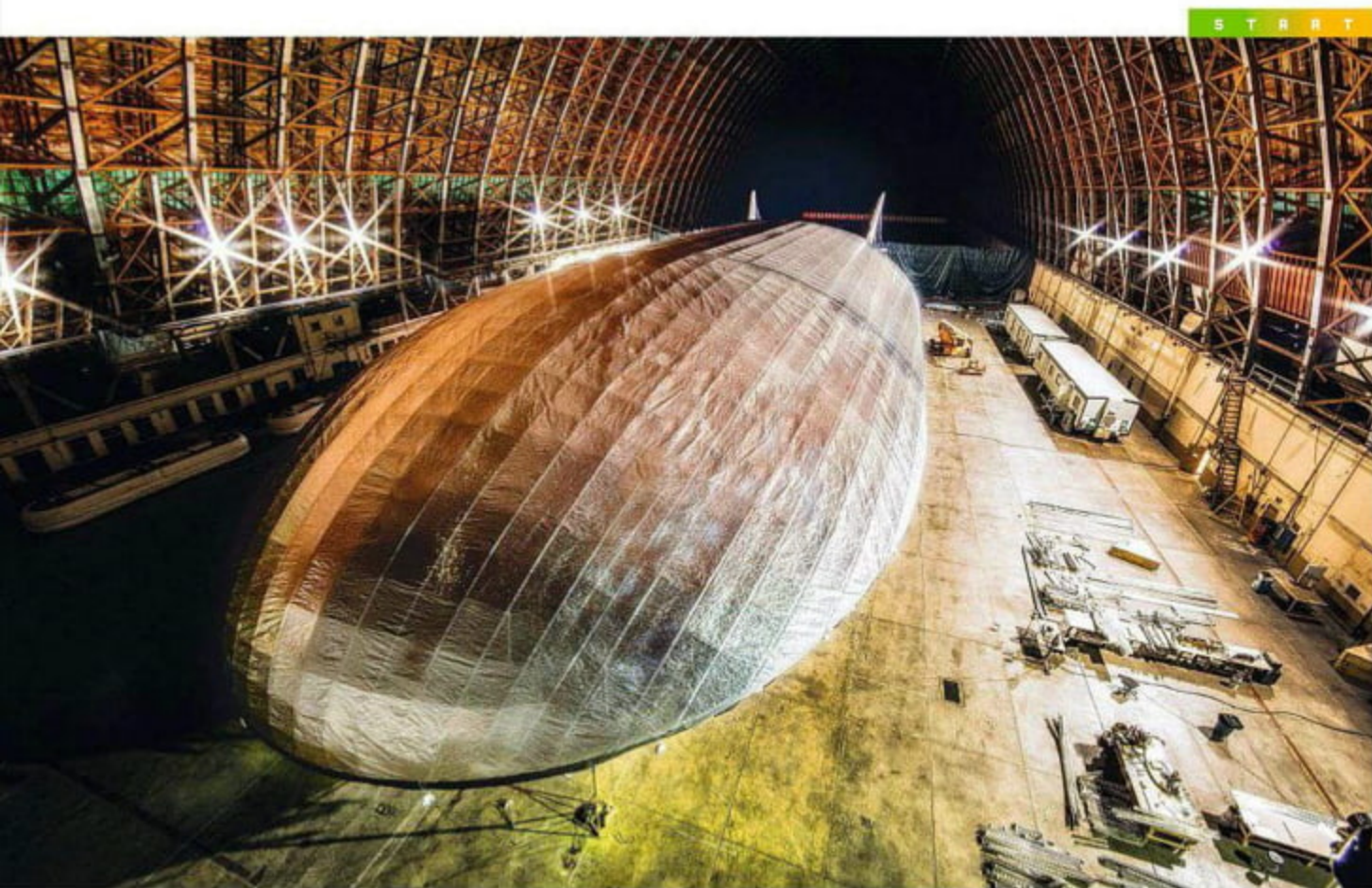


ILLUSTRATION: ROBIN SOYDEN



FIND YOUR WAY... WITHOUT GPS

If you've experienced the frustration of a jammed GPS while driving, BAE Systems' new device will be good news. NAVSOP (Navigation via Signals of Opportunity) is an alternative to GPS that uses local-radio, mobile and TV-transmitter signals to locate itself. "Whereas GPS uses data from satellites orbiting Earth, NAVSOP builds up a database of satellites on the ground, which don't move," says the project's principal scientist, Ramsey Faragher. "If GPS is jammed, or fails due to adverse weather, NAVSOP kicks in at the same level of accuracy." What's unusual is the way it calculates its location. "We wanted something that learns independently, so after a few days it doesn't need any external sources of data to work." The NAVSOP uses a learning algorithm that constantly corrects and recalibrates itself, based on confirmation from GPS. Quickly, it learns which signals to trust. "Eventually NAVSOP starts to treat GPS with suspicion and can tell if it's been tampered with," says Faragher. "All those signals can't lie to you." **MV**

WIRED INSIDER

EVENTS, NEW PRODUCTS,
PROMOTIONS AND COMPETITIONS
TO LIVE THE WIRED LIFE
COMPILED BY NATALIE FUTTER

1 HERMÈS PURE PERFUME LOCK-SPRAYS

Available in smart silver or premium gold, Hermès' limited-edition pure perfume lock-sprays are only available in Harrods and Hermès stores. The signature padlock has long been part of Hermès' identity – here it makes a protective case for four of its best-loved scents. Pivot the ring to release a mist of fine fragrance. uk.hermes.com

2 SIME LONDON CONFERENCE

The first edition of SIME London was held on September 28 and explored the boundaries of the digital society and how industries will need to evolve. It brought together an eclectic group of thought leaders, each one passionate and positive about the technological changes taking place in our world. sime.nu/event/london

3 RADO HYPERCHROME TIMEPIECE

Rado's black chronograph HyperChrome continues the Swiss watchmaker's tradition of using smooth high-tech ceramic for its cases and bracelets, always to striking effect. In this new model, contrasting gold hands create a bold, sophisticated look, and the case has been cast as a single, seamless piece of ceramic. rado.com

4 TAMRON 18-270MM LENS

The perfect travel companion, the Tamron 18-270mm F/3.5-6.3 Di II VC PZD impresses with its high level of usability. Featuring a focal-length range to cover every photographic opportunity, the lens can capture both sweeping vistas and close-up detail, with no colour or image distortion typical of lesser lenses. tamron.co.uk

5 CORPORATE ENTREPRENEUR AWARDS

On October 24 more than 200 business leaders and entrepreneurs gathered at the Design Museum for the Corporate Entrepreneur Awards, sponsored by Market Gravity and WIRED. The four winners were: BMW's DriveNow, Barclaycard's PayBand, Telefónica's Wayra and the BBC's Worldwide Labs. corporateentrepreneurawards.com



THE BIG QUESTION

"What companies, products and ideas are reinventing finance?"



MUHAMMAD YUNUS
FOUNDER,
GRAMEEN BANK

"Microcredit has and will continue to play a revolutionary role in finance. Providing collateral-free loans to the poor, particularly women, and enabling them to stand on their own feet, has changed banking forever."



JANE FULLER
CODIRECTOR, CENTRE FOR THE
STUDY OF FINANCIAL INNOVATION

"I'm a big believer in DIY finance. I'm very interested in online companies that provide direct links between savers and investors, and where their money is put. One category is peer-to-peer lending exchanges such as Zopa."



CAITLIN MACLEAN
SENIOR MANAGER, FINANCIAL
INNOVATION LABS, MILKEN INST

"In this period of austerity, new financial products are providing market-rate returns while catalysing much-needed social and economic development, such as financing treatments for infectious diseases."



SEAN PARK
FOUNDER,
ANTHEMIS GROUP

"Innovative startups such as Betterment are combining tech with modern design and user-experience principles to remove complexity and offer simple – yet powerful and intuitive – products and services."



ANDY DAVIS
ASSOCIATE EDITOR,
PROSPECT

"I'm an early-stage investor in Platform Black, an online auction platform that enables small firms to raise short-term finance by selling their outstanding invoices. It will revolutionise the way businesses raise finance."

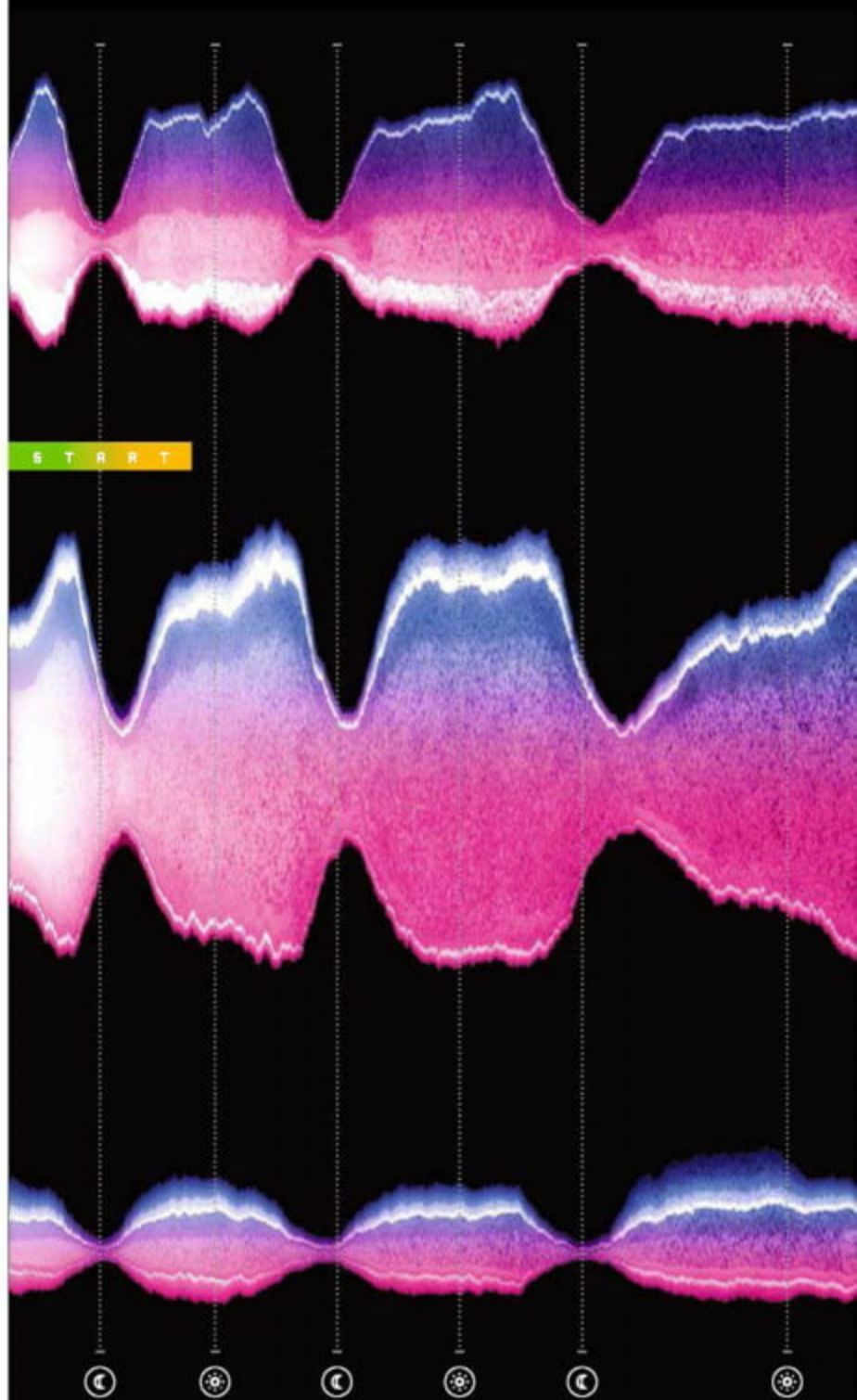


ERROL DAMELIN
FOUNDER AND CEO,
WONGA

"Traditional credit models rely on low headline rates, with stings in their tails. But consumers demand speed and flexibility. Transparent pricing, and giving people much more control over credit, is really rocking the boat." **MV**








How the world uses its phone

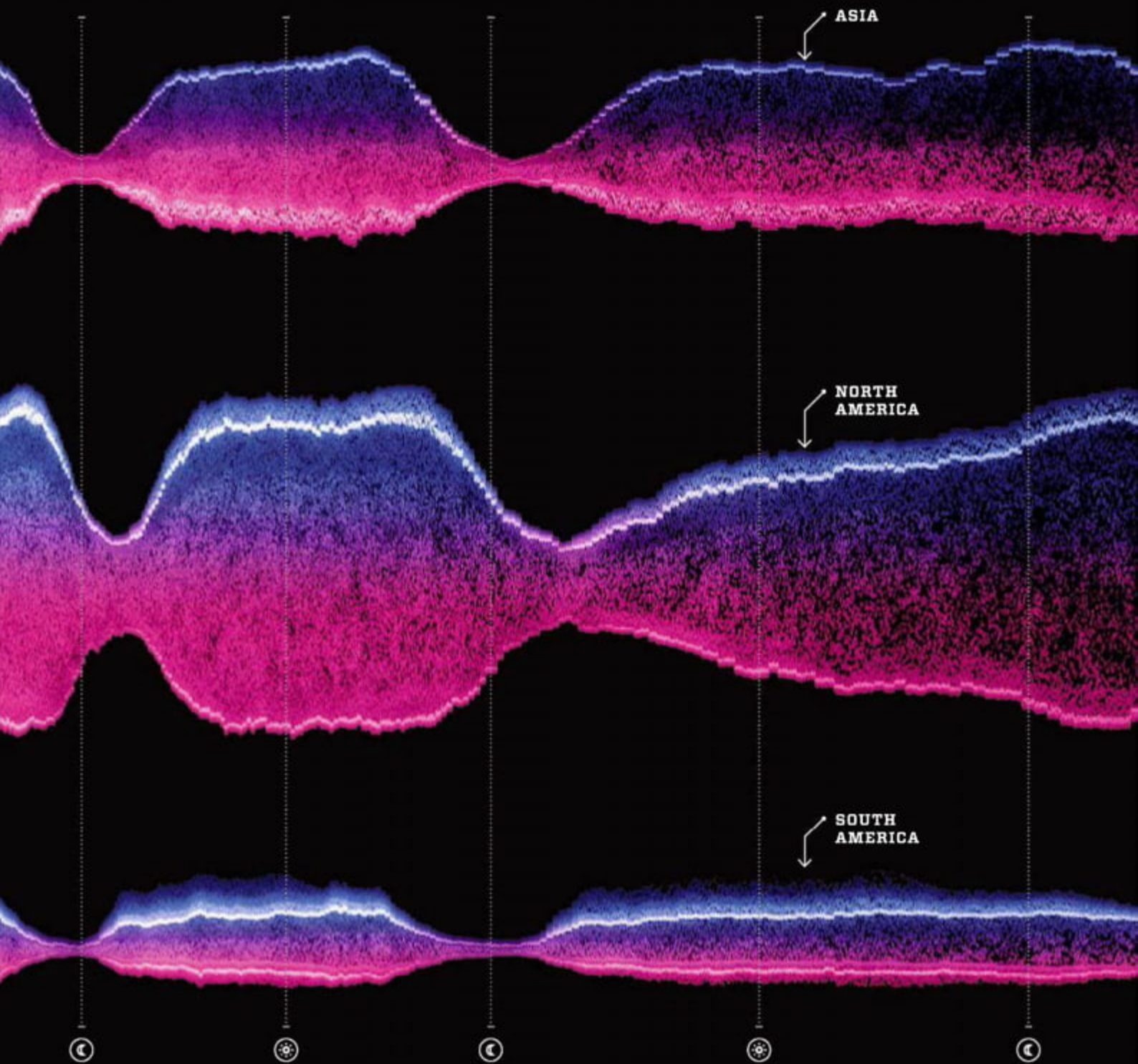
Using 33GB of data harvested from mobiles around the globe, MIT's SENSEable City Lab has visualised how people use their cellphone networks

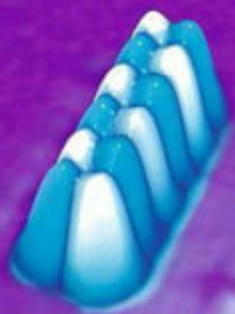


Our location defines our mobile-phone habits, according to Carlo Ratti. "You are looking at people's mobile activities – sending an email or updating Facebook profiles – separated across continents," says Ratti, director of MIT's SENSEable City Lab. He and his team used 33GB of anonymised data from Ericsson, harvested from 7,727,358 users around the world. They found that South America mostly browses the web, Asia watches videos and Europe is a social-networking continent. North Americans use their phones more than anyone else, as seen by their bulging graph. "The data was plotted on a logarithmic scale, so it shows in greater detail the most recent uses [on the right of the graphic], while old observations are compressed [to the left]," Ratti explains. "Phone networks can capture life on our planet." *MV senseable.mit.edu*



-  SOFTWARE UPDATE
-  SOCIAL NETWORKING
-  WEB BROWSING
-  VIDEO PLAYBACK
-  FILE SHARING
-  AUDIO PLAYBACK
-  EMAIL





BIG DATA CUT DOWN TO SIZE

The world's smallest data storage unit (above) is a mere 4 x 16 nanometres. But this array of iron atoms has a storage density 100 times greater than that of a conventional hard drive, fitting one bit of data into 12 atoms, as opposed to the more typical million. The potential for storing large amounts of data on tiny devices is, well, huge. "A patient's MRI scans could be stored on their National Insurance card," says Sebastian Loth, a researcher at the German Centre for Free-Electron Laser Science, who helped develop the method.

Collaborating with IBM's California-based Almaden Research Center, Loth's team arranged iron atoms in rows of six. The data is written into this unit using an electric pulse, at temperatures as low as -268°C. This pulse flips the magnetic state of pairs of atoms to represent either "0" or "1"; another pulse reads the data. The array is also aiding quantum-mechanics research.

"We are dealing with techniques and tools that manipulate at the quantum level," says Loth. "We must think of engineering at this atomic level if we are to go beyond current data-storage."

Charlie Foster cfel.de



Becky Pilditch taps a carbon-paint switch to turn on the light

Isabel Lizardi touches different areas of the poster to trigger music

Power to your paintbrush

Meet the London art students creating electrical circuits with nothing more than carbon paint

What if building an electrical circuit was as easy as drawing a picture of one? You could grab a battery and an LED bulb, paint a wire between them, and ping! Your light would turn on. A group of students at London's Royal College of Art have made that possible. Using electrically conductive carbon paint, they can draw a circuit on to fabric, paper, glass and even your own skin.

"If you paint it on your body, you become a part of the circuit yourself," says Bibi Nelson, cofounder of Bare Conductive. "You can

Matt Johnson dims or brightens the lights by touching the area around them

Bibi Nelson controls music by touching different parts of the painted stereo

START



decorate yourself with small LEDs to make light-up body art, or touch things in the environment to trigger a sound or light."

In November 2009, the team used an early version of the non-toxic paint to create "Humanthesizer", an interactive music video for UK dance artist Calvin Harris, in which painted dancers could trigger different parts of the track with each movement.

"The idea of the human circuit captured people's imaginations," says Nelson. "They all asked us, 'Can we draw it on anything?'"

Inspired by this, Nelson and fellow students Isabel Lizardi, Becky Pilditch and Matt Johnson launched Bare Conductive in September 2011 and began to sell "Bare Paint" online for people to experiment with (one

50ml pot costs £18). They now make educational classroom kits, bespoke greeting-card kits and customisable badge kits.

In the studio, Johnson shows how the paint can also be used to draw switches rigged up to control household electronics, and, when dabbed on, can turn any surface into a capacitive sensor – "it's similar to an iPad touchscreen's sensitivity," he says.

Currently, they are working with a record company to make Bare Conductive concert posters. When you touch the painted posters on the street, they play music samples.

"We're trying to show people a variety of futures," says Johnson. "We want them to reimagine the idea of electronics and electricity." MV.bareconductive.com

London-based artist Alicja Pytlewska painted the conductive images on the walls

Big air, short fall

Ramp shape can mean the difference between life and death – or serious injury – for thrill-seeking snowboarders

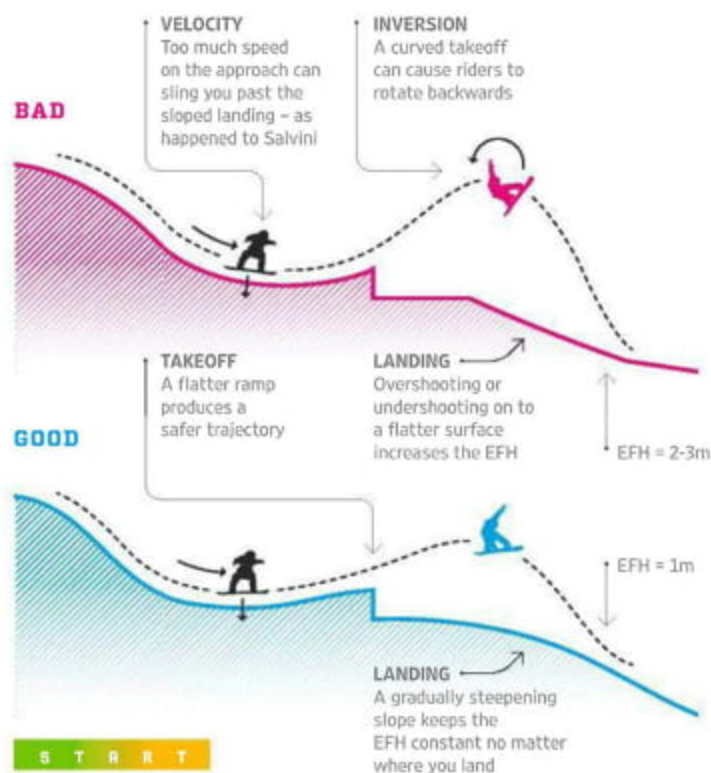


PHOTOGRAPHY: COLE BARASH

Kenny Salvini hit the slopes with his friends one night in February 2004 and scored major air off a terrain park ramp. Only trouble was, he then plummeted from the height of a three-storey house and landed on his back. It's easy to blame youthful daring and bad luck, but it turns out that the raw physics of the ramp were also against him. Paralysed from the shoulders down, Salvini was awarded \$14 million (£8.7 million) in damages when engineers' testimony showed that his injuries partly resulted from the jump's design.

Most terrain parks don't stick to mathematical standards, but physicist Jim McNeil thinks better specs could prevent accidents. He suggests a simple metric to reduce risk: equivalent fall height (EFH), which expresses the shock a jumper absorbs in terms of an equivalent vertical drop on to a flat surface. A well-designed ramp can launch you to a height of around 10m, yet have an EFH of just two.

Not everyone buys it. The equations governing EFH "assume that the human is like a cannon ball", argues sports-injury researcher Jake Shealy, who worries that it doesn't allow for variables such as rider skill and snow texture. McNeil counters that the formula can suggest designs to minimise risk. He's also built a device to analyse jumps. Since you don't have one, though, be sure to look before you leap. And land feet-first. **Katie M Palmer**



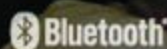
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You've got all that music on your phone. Enjoy it out loud with the SoundLink® Bluetooth® Mobile speaker II – now with improved acoustics for deeper, more powerful sound. Just flip it open, make a quick Bluetooth® connection and you're ready to play your music with better sound than you thought you could get from a speaker this small. It works with your smartphone, tablet or other Bluetooth® devices, including Apple® and Android™, and has a battery that keeps the music going for hours. Now you can share your music and enjoy it with better sound, wherever you go.



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scan to
learn more
m.bose.eu/sim_en



You are looking into the world's largest wind tunnel devoted to automobile testing. This tunnel is the heart of General Motors' Aerodynamics Lab in Michigan, where the automotive giant tests the shape and design of every car it develops. With a 5.5 x 10.5-metre test area, this cavern is where General Motors appraised its most streamlined cars from last year, including its electric model, the Chevrolet Volt, which has a drag coefficient of 0.28 (the lowest in the company's 104-year history), and the Opel Adam, one of the most fuel-efficient cars of its class, which was unveiled at September's Paris Motor Show 2012.

Driving data with the wind

General Motors' massive wind tunnel helps to make car design less of a drag, and saves on fuel, too

"To simulate what happens when cars move through air, we move air past cars at speeds as high as 220 kilometres per hour," says Frank Meinert, the lab's senior engineer. "In the 32 years that we have been in operation, we have run about 21,000 tests in total."

When you drive at typical motorway speeds, more than half the wheels' power is lost to aerodynamic drag; using a wind tunnel to ascertain and reduce drag is key to improving car design and fuel efficiency. "We haven't yet found a way to invent cars without tyres," says Meinert. "So until then we're going to be very busy." **MV**

% WIRED INDEX

50%

Average of Greenland's surface ice that melts in July, over 30 years

97%

Percentage of Greenland's surface ice that melted in July 2012

11,447

Number of crimes in New York City, out of 79,000, which involved Apple products (January to October 2012)

170 LITRES

Amount of sperm at the world's largest sperm bank in Denmark

20,609

Number of babies it has created in the past 25 years

\$40 BILLION

Value that Facebook lost between its IPO and October; it's the worst performing large IPO on record

79 MONTHS

Average time it takes to retract a scientific paper when a scientist has been implicated in misconduct

22 MONTHS

The same when there was a junior researcher implicated

94.2%

Percentage of TV-related social-media comments in US prime-time on July 27, 2012, about the London Olympics Opening Ceremony

For sources, see Colophon (p146)

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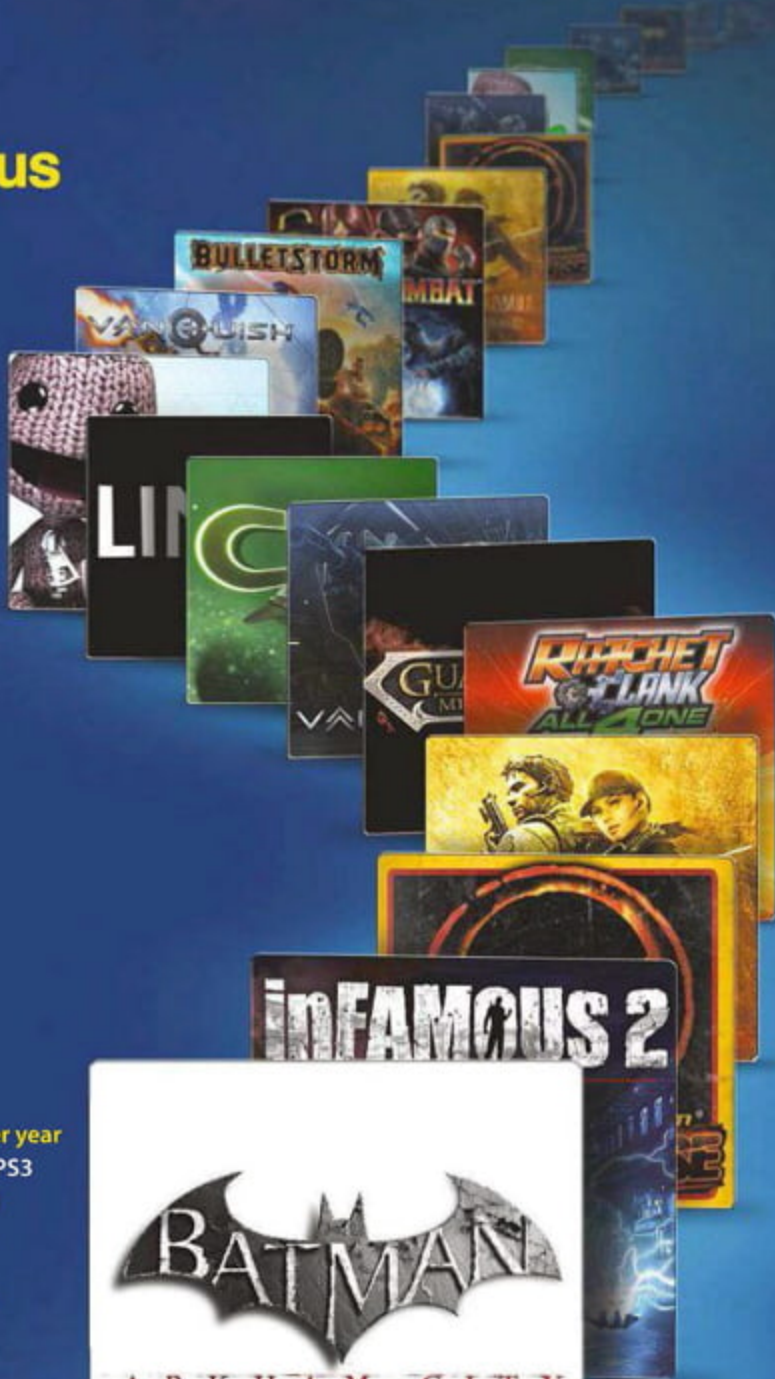


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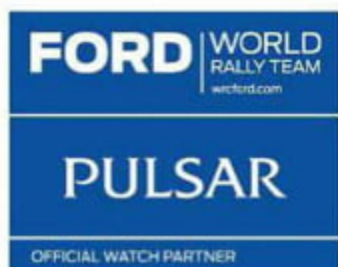


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Dangerous driver

Manal al-Sharif defied a Saudi ban on women driving – and faced death threats

On May 19, 2011, Manal al-Sharif, a divorced mother of two and internet security consultant for Saudi Aramco, the Saudi Arabian national oil company, was filmed by a friend driving through the city of Khobar. She posted the eight-minute video on YouTube, and in it she says in Arabic:

"We are ignorant and illiterate when it comes to driving. You'll find a woman with a PhD and she doesn't know how to drive. We want change in the country."

Within two days the video was watched 600,000 times on YouTube. Then she was arrested.

"The religious police came into my house at 2am," Al-Sharif, 33, told the WIRED2012 conference in London last October. "They took me and my brother. I was detained for nine days. My picture was on the front of all the newspapers, all saying horrible things about me."

In Saudi Arabia, al-Sharif's bravery emboldened an existing campaign, Women2Drive, which promotes women's right to drive – something that's banned.

"There's no actual law – it's an unwritten law," says al-Sharif. "I was mad, because the day before I had to walk for 40 minutes from my clinic to my house and cars were honking and following me."

For al-Sharif, the real issue is not just driving, but human rights.

"For instance, in Saudi Arabia all women, even married ones, need permission from a male guardian to work or study," she says.

According to her, the movement is making a difference. In September 2011, King Abdullah gave women the vote. Last May, al-Sharif was awarded the Václav Havel prize for creative dissent at the Oslo Freedom Forum.

"I asked my bosses for permission to go to the ceremony in Oslo," she says. "They refused and told me that they didn't want their name associated with me. I resigned." Now living in Dubai, al-Sharif is currently taking time off to write a book, entitled *Kingdom of Saudi Men*.

"So many lies have been told about what I did," she says. "I want to document the truth for my son. My family is afraid. I have had death threats. But they know they cannot stop me. They messed with the wrong woman." **JM** manal-alsharif.com

START



Al-Sharif's May 2011 YouTube video. (Main picture) Her sign reads: "My rights, my dignity"



This plant can tell the difference between a handshake and a fist bump. This is just one application of Touché, a new type of sensing technology that recognises complex gestures rather than the simple binary of touching or not.

The Botanicus Interactus (pictured) uses Touché to turn the plant into a controller where each prod or grab is recognised as a different "button". Unlike previous technology, Touché measures this charge across a range of frequencies, allowing it to differentiate between, say, a tap and a grasp. "It highly expands the range of what capacitive sensors can do," says inventor Ivan Poupyrev, 42, a senior research scientist at Walt Disney Research in Pittsburgh. "It can run over wireless, we have a Bluetooth version, and it's tiny - about the size of an iPod nano."

The technology can add interactivity to nearly any object. For example, Disney Research is experimenting with a smart door-knob: close a door with one finger and a "be right back" message appears on a screen; pull it shut with your whole hand and the door locks. "The problem is not actually coming up with new ideas; the problem is choosing the best ones," says Poupyrev. Let's just avoid adding it to nettles. **James Vincent** disneyresearch.com

This orchid thinks it's an iPad

A new sensory system enables objects to respond intelligently to human touch

START

ALCOHOL WITHOUT THE HANGOVER

What is non-alcoholic and non-toxic but gives you the buzz of a beer? Synthetic alcohol, according to David Nutt of the Brain Sciences Division at Imperial College London.

Nutt, formerly the government's senior drugs adviser, has identified a substance that is alcohol-free but acts as a substitute. It has a chemical structure similar to benzodiazepine, a class of psychoactive drugs that treat anxiety and insomnia. The as-yet-unnamed drug can produce alcohol's desirable effects such as sociability and relaxation, but without negative effects such as nausea.

"We can get rid of most of the toxicity. We'll have a compound maybe 100 times safer than alcohol," claims Nutt. This means less damage to the heart and liver, but it also lets you wake up fresh. "Because it targets a specific receptor in the brain, we can reverse the effects if people want to drive home," adds Nutt. The antagonist could come in the form of a pill, or a dissolvable film that is placed under the tongue.

Nutt is testing the compounds on human subjects. The substance may be on sale within two years and, he says, would cost the same as a cocktail. **Sam Scott**

ILLUSTRATION: NEIL STEVENS



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HOW TALKING TOM BUILT AN EMPIRE

You might think talking to an animated cat is a waste of time, but you'd be disagreeing with 120 million people. Cyprus-based startup Outfit7 has built a business – 19 mobile and tablet apps – out of exactly that. Its *Talking Friends* series of apps, in which animals repeat what you say, have been downloaded 500 million times in 26 months. Outfit7 has more than 120 million active users, 30 per cent of whom have downloaded two or more apps. With no outside investment, the firm has set up offices in California, London, Slovenia and Seoul.

"When we founded the company in early 2010, the goal was to make a mobile game for pure entertainment," says Narry Singh, Outfit7's "chief business guru". So they launched *Talking Tom*, an animated talking cat, which is now one of 18 different versions. The apps allow users to feed the animals, play games and watch videos featuring the characters. The company collects vast amounts of data from users: "Talking Tom was fed 1.7 billion virtual glasses of milk [in 2011] by users," says Singh, 44.

Disney recently produced ten online cartoon videos featuring the *Talking Friends* characters, and Singh says that by 2013 *Talking Friends* will have their own US TV show. "Our goal," says Singh, "is to be a transmedia phenomenon." **MV** outfit7.com



24-hour eco racer

Lighter, faster, cooler – this prototype Nissan uses the race track to test efficiency savings

At the 2012 Le Mans 24 Hours race in France, an experimental racer made its debut. The Nissan DeltaWing started as a prototype for a new IndyCar – the US equivalent of Formula One – but the development team set its own target: to match the performance of a traditional endurance racer while reducing tyre wear and fuel consumption by 50 per cent. "This car needs less fuel, so refuelling is reduced and it can be filled more quickly," says Don Panoz, an American racing entrepreneur and managing partner of the DeltaWing project. "The tyres are smaller than conventional race tyres so they are easier to handle in the pits and, because the car is so light, they last longer."



● The driver sits far back in the car, almost over the rear axle, looking down the long, narrow fuselage

● The compact front tyres are less than 58 centimetres tall, with a tread just ten centimetres wide

Rather than using more traditional race-car wings to create down-force, the car uses a twin-vortex underbody system – the air travels under the car faster than over its body, creating the down-force needed to corner fast and keep the car stable at speeds of up to 315kph. “The project is about proving pioneering technology in the world’s most public laboratory,” says Darren Cox, general manager of Nissan Europe, which supplies the engine. This engine is a direct-injection, 1.6-litre turbo that, with a five-speed sequential gearbox, can deliver 300bhp at 7,400rpm, and 309Nm of torque from 4,000 to 6,750rpm. That’s less than half the power of Audi’s Le Mans-winning R18 e-tron, but at 900kg the Audi weighs almost twice as much as the DeltaWing – the Nissan car’s monocoque chassis and carbon-fibre body panels mean that, without fuel or driver, it weighs just 475kg.

At Le Mans, the car was eventually punted out of the race by a Toyota after 75 laps, but it still achieved 4.5km/l, half as much as an equivalent Le Mans LMP2 racer. In October in the US, the car came fifth in the 1,600-kilometre/ten-hour Petit Le Mans at Road Atlanta in Georgia. Drivers, start your super-efficient engines. [Alistair Weaver deltawingracing.com](http://deltawingracing.com)

EARLY ADOPTERS



What’s exciting...

ERIC TOPOL

Director, Scripps
Translational Science Inst

“The next phase of sensors – **embedded microchips**, smaller than a grain of sand, implanted into the bloodstream by a simple injection. These will monitor the blood constantly and send signals to a smartphone. A ringtone could warn you of an immune response, a heart attack or a cancer that is percolating but not yet a sealed fate.”



What’s exciting...

MATT MULLENWEG

Founder,
WordPress

“The **Nikon Coolpix S800c** Android camera has a full touchscreen so you can have *Instagram*, *Path*, *WordPress* and *Twitter* apps running natively over Wi-Fi. This is a rough, first-generation product, so I wouldn’t recommend it, but all future cameras will have Wi-Fi, LTE and the apps you have on your Android or iPhone.”



What’s exciting...

KEN BANKS

creator of
FrontlineSMS

“Andrew Zoll’s book, ***Resilience: Why Things Bounce Back*** sums it up best. We live in a time of increasingly regular natural disasters, social unrest, economic collapse and technological disruption. This book asks whether we can build better shock absorbers for ourselves, our economies and for the planet.”

INCUBATING THE BIG IDEAS OF TOMORROW

TELEFÓNICA'S GLOBAL SEARCH FOR THE NEXT 'FROG PRINCE' OF TECH

Some event sponsors happily take a back seat when it comes to on-stage action. Not WIRED2012's anchor partner, Telefónica.

For the telecoms giant, the event offered the perfect setting to show off the talent discovered by Wayra, its tech incubator. Founded in 2011, Wayra operates in eleven countries across Europe and Latin America, with 12 academies and 172 startups.

"We're a global company working in a changing industry," said Steven Bartholomew, Director of Public Affairs at Telefónica Digital. "What's worked in the past might not work in the future, so we need to create new ecosystems."

By hooking up with young companies with fresh perspectives, Telefónica gains access to a pool of ideas and creative people. The startups benefit from technical expertise and the chance to take their products to Telefónica's 300 million customers.

"We've been kissing frogs," said CEO Gonzalo Martín-Villa when he took to the stage at WIRED2012. "The frogs are the startups and we are looking for princes."

He went on to introduce four of Wayra's most promising "frogs" and asked the gathered delegates to pick the one most likely to blossom into a prince.

Up first was Andy King, cofounder of Blue Butterfly. The London startup's app uses NFC to simplify connecting mobile devices to public Wi-Fi. Instead of passwords and registration, users tap an RFID chip for instant connection. It also works with QR codes for those without NFC.

Next came Machina, a Mexico City-based clothes company that creates "wearable machines". Some garments play or influence music, while others feature lights for cycle-safety – or just look good. The line is aimed at "people who don't relate to brands," said founder Linda L Franco.

Nick Redwood introduced his startup, Makelight Interactive. The London company's app transforms smartphones into "pixels for light shows" at live events, allowing

users to become part of the lighting system – their screens displaying colours, patterns and pulses dictated by the performer.

Finally, Jesús M Pérez introduced Madrid-based Tedcas, a gesture-controlled user interface for doctors. Using Kinect technology, Tedcas allows surgeons or doctors to

view and navigate digital data or images – without touching a screen or computer, which would risk contamination.

So who was deemed to be the winner? Tedcas triumphed by a whisker. It seems we can't wait for a hint of *Minority Report* at the health clinic. telefonica.com/digitalhub



WIRED 2012

Together with
Telefonica



Four of Wayra's most promising startups from Europe and South America:

Blue Butterfly's NFC app simplifies the process of connecting to Wi-Fi, by using an RFID chip instead of passwords.

Machina's "wearable machines" are tech-laden clothes inspired by freedom, open source and DIY social movements.

Makelight's app transforms smartphone screens into artist-controlled lights for live events, such as gigs and concerts.

Described as "*Minority Report* for doctors", **Tedcas** is a gesture-controlled interface intended for use in operating theatres.

LIVEWIRED WITH O2



WIRED2012 was no ordinary event. So when the first day's talks were over and it was time to party, expectations for WIRED2012 with O2 were high – especially considering that this network knows a thing or two about putting on parties.

The evening didn't disappoint. Stand-up comic Jason Manford welcomed delegates and speakers before introducing the first act of the night. Soon, London 2012 bronze medal-winner Kristian Thomas was wowing the crowd with his pommel-horse moves. Later, the Olympian was joined by team mate and silver medallist Louis Smith, to chat

and pose for photos.

As revellers chilled with well-deserved drinks – squeezing in even more networking time – laser harpist Theremin Hero brought the room to life with his neon visual-and-aural feast. Meanwhile, back on the main stage, the temperature was cranked up by cabaret hula-hoop dancer Pippa the Ripper.

Eventually, it was time for the headline act, Jessie Ware. The velvet-voiced electro artist provided the perfect sound track for those winding down to call it a day, as well as for the party animals revving up for a night out, ahead of WIRED2012's second day of disruption.



WHAT'S INSIDE: PRINGLES SOUR CREAM AND ONION

Open wide

This crunchy snack has an antiseptic acid also found in your dentist's surgical toolkit

Every month WIRED's chemist Dr John Emsley deconstructs an everyday product. He is the author of 110 research papers and 12 books, including *Nature's Building Blocks*, 2nd edition (OUP). johnemsley.com

INGREDIENTS

Maltodextrin
Dextrose
Onion flavour
Lactose
Citric acid
Monosodium glutamate
Sweet whey powder
Disodium inosinate
Lactic acid
Malic acid
Emulsifier

MALTODEXTRIN

This acts like an edible glue and is made from corn starch. It consists of glucose molecules.

DEXTROSE

Also known as D-glucose, this is the right-handed form of glucose. It's produced by plants.

ONION FLAVOUR

When an onion is cut, enzymes get to work and release thiopropional-S-oxide (C_3H_6SO), the flavour.

LACTOSE

Consisting of two carbohydrate molecules, glucose and galactose, this is used to bulk up pills.

CITRIC ACID

Made by fermenting sugar with the fungus *Aspergillus niger*, citric acid is common in detergents.

MONOSODIUM GLUTAMATE

This is made from amino acids and is the basis of the moreish umami flavour.

SWEET WHEY POWDER

This is made by evaporating the liquid left after milk has been curdled.

DISODIUM INOSINATE

E631 is the disodium salt of inosinic acid. Here it enhances the snack's umami.



LACTIC ACID

This is produced in the body as a by-product of burning glucose. It's added to skin creams.

MALIC ACID

Found in fruit, malic acid is in makeup and is used by dentists as an antiseptic when filling cavities.

EMULSIFIER

E471 consists of long chain fatty acids bonded to glycerol. It ensures that the ingredients blend.





SAMSUNG SMART TV
AT WIRED2012

CAN SMART TV CHANGE THE WORLD?

A GLIMPSE INTO THE
FUTURE WITH THE
SAMSUNG ES9000



SAMSUNG SMART TV

DEBATING DELEGATES

WIRED2012 GUESTS PREDICT THE IMPACT OF THE SMART TV REVOLUTION

The idea behind WIRED2012 was to offer a glimpse into the future. So when headline sponsor Samsung SMART TV showcased its super-slim ES9000, it was the perfect opportunity to debate what impact SMART TV will have on the world of tomorrow.

In an exclusive VIP breakfast attended by some of WIRED2012's most inquisitive minds, WIRED contributing editor Daniel Nye Griffiths posed the question: "Can SMART TV change the world?"

It might seem an overly lofty topic, but a glance at the ES9000's spec sheet will convince you otherwise.

The 75-inch screen makes it Samsung's largest ever LED TV. With verbal and simple gesture-based controls, users can intuitively interact with the technology. The SMART TV can be personalised with apps, games and catch-up services. Samsung's Smart Evolution Kits will keep it up-to-date with timely add-ons that boost memory, graphics and processing ability.

But where did WIRED2012's delegates see this "smartness" leading? To capture the thought experiment, artists from Scriberia – a real-time illustration company – sat in on the action.

One might have expected a lack of sparking synapses following the prior evening's drinks reception, which was hosted by WIRED publisher Rupert Turnbull, and Robert King,



vice president of consumer electronics at Samsung UK and Ireland. With the reception marking the official start of WIRED2012, it was the first opportunity for speakers and delegates to network – and enjoy a glass or two of bubbly.

Nonetheless, the morning debate was heated, offering participants an inspiring look at the future of entertainment.

One prospect is how SMART TV can interact not only with people, but also with machines: your fridge could warn you that you're low on milk by subtly interrupting your viewing. Want that awesome new product being advertised on-screen? Shout "buy" at the TV, and your 3D-printer could whirr into life.

THE DEBATE
DEPICTED
BY DOODLE

To record the prebreakfast discussions at WIRED2012, there could have been journalists assigned to each delegate-crammed table – but that wouldn't have been very WIRED.

Instead, artists (known as "scribes") from London-based illustrators Scriberia, sat alongside the dining debaters. Their job? To take each topic discussed, and distil it into a simple visual.

Scriberia's Chris Wilson later incorporated the various sketches into a single design (right). "We managed to capture and visualise loads of great comments and concepts about SMART TV and the impact it will have," says Wilson. "From 3D-printing advertised goods to curating your own family channel."

A finished digital version was displayed in Samsung's SMART TV demo room on the 75-inch ES9000, introducing the debate to the rest of WIRED2012.

So what do you think? Answers in sketch form only, please...

FUTURISTIC FEATURES

Robert King, vice president of consumer electronics at Samsung UK and Ireland joined the breakfast debate to point out the ES9000's top features.

As one delegate put it: "It's a balance between 1984 and awesome!"

The idea of a "TV with a brain" sparked imaginations too, particularly when married with facial recognition. Perhaps the SMART TV of tomorrow will curate content tailored to different viewers? Or might





Smart interactions

A built-in camera recognises faces and profiles, giving viewers access to favourite apps and settings. A wave of the hand activates motion control, so you can surf the web, browse content, adjust the volume and more.

Smart content

Take advantage of catch-up services such as ITV Player (only on Samsung SMART TVs) and on-demand content from LOVEFiLM and Netflix. Play Angry Birds®, or enjoy Samsung's exclusive Family and Fitness services.



Smart Evolution

Samsung has future-proofed its 2012 range with Smart Evolution. Owners can upgrade their TVs every year for up to four years with plug-in kits that boost memory, graphics and processing.

it offer certain shows when different people enter the room?

Others were excited about the revolution occurring in the mobile space, as it enters the living room. Phones and tablets are perfect for individuals, but a connected 75-inch screen could create bespoke

social experiences for an entire family.

A SMART TV might reduce the amount of time we spend in offices, by bringing video conferencing to the living room. It can be an educational device, with learning tools just an app away. Maybe you'll use it to keep fit – the ES9000 already boasts

a virtual exercise assistant to record your progress on personalised routines.

But what excited breakfast-goers most was the idea that science fiction is quickly meeting reality – and that the Samsung ES9000 is the stepping-stone between these two worlds. samsung.com/uk

SAMSUNG SMART TV
AT WIRED2012

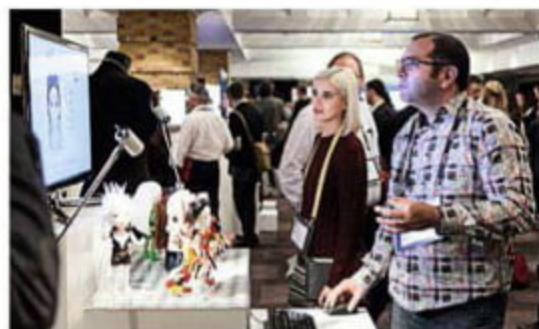
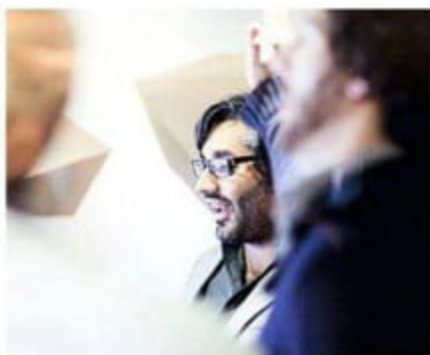
DESIGN MEETS TECHNOLOGY

Tech and toys were just as much a part of WIRED2012 as the talks. The Design Meets Technology area, featuring WIRED's favourite products, proved that.

Here, Samsung's SMART TV demo room (above) treated a constant stream of delegates to hands-on (or hands-off) demonstrations of the 75-inch ES9000 – with its gesture controls and voice recognition. In the gaps between, the 7.9mm rose-gold bezel framed Scriberia's sketch in glorious 1920 x 1080 definition.

Elsewhere, hacker's hero Sugru showcased its magic, malleable rubber; MakieLabs' figurines stared out with 3D-printed eyes; and Team BlackSheep's drones sat awaiting their next flight.

The objects sparked conversation, but Samsung's ES range of TVs gave them life. Each display-stand featured a SMART TV, bringing HD visuals, stylish design and a crystal-clear picture to the array of toys, tech and design. Now that's smart. samsung.com/uk





WIRED2012: AN INSIDE REPORT

OUR SECOND CONFERENCE, IN OCTOBER 2012, DELIVERED 49 THRILLING, INSPIRATIONAL TALKS FROM INNOVATORS, INVENTORS AND THINKERS

WIRED
2012

Together with
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REPORT BY PATRICK KINGSLEY

PHOTOGRAPHY: DAN BURN-FORTI

At one point during the WIRED2012 event at the end of October, WIRED's editor, David Rowan, said, "There is no one here you wouldn't want to meet." Two intense days and 49 speakers later, that promise has been kept. During a session on the first morning, Tumblr founder David Karp joked that his back-up plan is modelling. As it happened, his successor on stage actually was a model: Lily Cole, who was there to explain her new social network, Impossible. Not that impossibility is a concept the speakers embraced. Korean artist Hojun Song is planning to send a satellite to space;

web developer Mark Suppes is building a nuclear reactor in his garage in Brooklyn. Collaboration, though, is something everyone understood. Tod Machover is composing a symphony with the citizens of Toronto, whereas neuroscientist Sebastian Seung wants you to map the brain.

Not everyone agreed - and the line-up was richer for it. Tim Harford argued that creativity is derived from embracing the unknown, whereas Ferran Adrià maintained it comes from obsessively documenting what you do know. Elsewhere, roboticist Limor Schweitzer had robots that dance

like humans - and musician Imogen Heap created music through an interface that connects the human body to sound.

The thread that ran through the event? The inspiration and optimism offered by the innovators, entrepreneurs and inventors who are defining the future. ➡

TRENDING. **OCTOBER 25, 2012**

The #WIRED12 conference hashtag was in the UK top ten for most of the day, having been tweeted 1,454 times (and a total of 6,397 times in the whole month)



THOMAS HEATHERWICK

DESIGNER. DAY 1. CONSIDER THE OPPOSITE

The creator of the 2012 Olympic cauldron ignored not only his brief but also the hapless examples of precedent

The organisers of London 2012 told the designer Thomas Heatherwick that there was an important criterion that he had to fulfil when making the cauldron to house the Olympic flame: "Make sure you have no moving parts." It was a tough commission, he told the conference: Olympic cauldrons have traditionally been instantly forgotten. "No one seemed to actually remember what a cauldron looked like," he said. The only example his team could recall was the one at Barcelona in 1992 – and that was memorable not for its design, but for the way it was lit by an archer's arrow.

Others have simply been ugly. "Doof!" said Heatherwick, mocking how his pre-

decessors had plonked cauldrons on top of stadiums in the same clumsy way that the stars of *Starsky and Hutch* dumped a blue magnetic light on top of their police car. But, realising that "there was something almost religious in the liturgy of an Olympic games", Heatherwick wanted to do the opposite, something "rooted and earthy". So he did exactly what he was told not to. He used moving parts – 204 of them, to represent all of the compet-

@LAURENTHAUG #WIRED12 was inspiring, here are the ideas I gathered <http://bit.ly/RsgNH8>

ing Olympic nations. Each part took the form of a petal, Heatherwick explained, and was carried into the arena by a competitor from a different country. The petals were planted on stakes, filled with fire and then hoisted aloft simultaneously – until they formed one united inferno, blazing 30 metres above the ground, creating one of the most memorable sights of the opening ceremony. It symbolised, Heatherwick said, "the very moving coming together of these countries, who were not squabbling, for two weeks." In the process, it summed up the games far better than a conventional cauldron could have: "The manner in which [the cauldron] was lit was manifested in the object it became."

Such a design, Heatherwick said, reflected his "deep interest in the strategic reasons a project is generated". Asked to design London's new Routemaster bus, for example, he realised that for 50 years no transport designer had understood what it's like to actually travel on a bus. "If you sit at the back [of other buses]," he reminded the audience, "you can see the discussions that went on, [the decisions] that made the handrails nuclear yellow, and that meant we have fluorescent tube lighting like the kind you would find in a chicken farm." Heatherwick, by contrast, determinedly set out to do what other designers didn't: "To make the bus reconnect with the dignity of the passenger."



A

t the start of his talk, a breathless Ferran Adrià said, "You might be asking why I'm still wearing my badge." It is a fair point: delegates had been given a large, laminated ID card to wear, but most speakers took them off to talk. Adrià's remained around his neck – and, he added, "you might be wondering why it's so big."

Such questions are a good thing, argued the Catalan chef. It's always good to ask why: asking "why?" was what had made him obsessed with molecular gastronomy; asking "why?" helped him turn elBulli into the world's most celebrated restaurant. Asking "why?" also led him, counterintuitively, to close it. The reason? There were financial pressures: dozens of courses for 50 diners a day, with a staff of 80, is capital intensive. But there was something else: "We wanted to continue being creative," he explained.

The pressure of daily service, he said, left him with very little time to invent new things. So he closed elBulli and, in its stead, he has created The elBulli Foundation, which will provide an exhaustive archive of the near quarter century of Adrià's creations while head chef at elBulli and also provide a multidisciplinary space for creatives and academics of all backgrounds. It will be, he said through his translator, "an experiential centre about efficiency and innovation, that studies the process and the way that these are audited."

Creative audits, he continued, are badly needed in every discipline. "How many companies have a department that controls and audits what their creators are developing? How many can control and track their innovation and creativity? Very, very few." This is problematic. "Most of us put our clothes away anyhow," Adrià said, "and we're bad at finding

@RAGHAVAKK Conference was simply mind-blowing! Such a pleasure to be there! Thank you!

where we left our things. My philosophy: if your knowledge is in order, you will be efficient." The elBulli Foundation is an attempt to formalise efficiency: to audit the 14,000 pages of elBulli's own work, and to help others to do the same. "It uses cooking as a language, creating a dialogue with other disciplines," Adrià said.

A white asparagus appeared onscreen. For Adrià, the vegetable is emblematic of another kind of creative audit: Bullipedia. The foundation's second major project, Bullipedia aims to be a Wikipedia for chefs – an open source, online encyclopaedia that will provide information on ingredients and techniques. Type in "white asparagus", for example, and you'll find out why it's white, where it comes from, how it's been cooked throughout history, and the myriad ways it can be cooked today. Bullipedia is an attempt to create a database that contains all the world's information about cuisine. "One of the problems I find with the web is that you get information, but you don't acquire knowledge," Adrià said. "We want people to acquire knowledge through navigation."

FERRAN ADRIÀ

CHEF/EDUCATOR. DAY 1. INNOVATE THROUGH ITERATION

Adrià's message: "Information is being told that a tomato is a fruit; knowledge is not putting it in a fruit salad"



K

eren Elazari walked on stage, tapped her laptop and started hacking her audience's mobiles. It was slightly scary. Lots of WIRED2012 speakers had talked about hacking, but she was the first to do it live. Someone, she revealed, was currently surfing the Cheezburger website. Someone else was on Dropbox, their every movement projected on screen. All because they joined a bogus Wi-Fi network Elazari set up earlier that day. "Yesterday," she boasted, "I was browsing everyone's Twitter and Instagram feeds."

An Israeli cybersecurity expert with a decade of experience in the field, she made a serious point: today, there is eight times as much mobile traffic as there was across the whole internet in 2000 – and yet very few mobiles are protected against hackers. It's "an attacker's wet dream", she said. "We really are in an era with data all around us, we're collecting it, analysing it. Information is power, we're told, but without access to that info, we're powerless. Where is your data? Where is it being transmitted? Are you in control of it?"

"We carry devices that hold our most personal information," Elazari said. "It has everything they want to know about you, but fewer than one in 20 smartphones and tablets run security software."

A deathly laugh filled the hall. This, smiled Elazari, is the kind of unwelcome

noise you can expect to hear if you download a dodgy phone app. She heard it herself, she said, a few days ago when she installed what she thought was an app for a stopwatch. It wasn't. It turned her screen black, emitted the spooky laugh, and emailed a photo from her account to an unknown recipient. It's just a matter of time before it happens to you, Elazari suggested. "More than 70 per cent of malware for Android phones is malicious applications hiding inside applications that look normal," she says. And it's difficult to know which are harmful, and which aren't.

So how can we keep ourselves safe? Well, try not to use mysterious Wi-Fi networks: "Using 3G is always better." If you can, stick to sites that use secure proto-

@TOSIN_OGUNRINDE
#WIRED12 in a word:
inspiring!

col, or HTTPS. And if you have a virtual private network (VPN), use it. Downloading mobile-specific anti-virus software wouldn't hurt either. Elazari recommends Zimperium, a security firm based in her hometown of Tel Aviv. More generally, treat your mobile as a PC. "Just think," Elazari reminded us. "Would you do the same if you were using your laptop?"

"I can assure you that the WIRED app is quite safe," smiled David Rowan as Keren Elazari left the stage.

KEREN ELAZARI

CYBERSECURITY EXPERT. DAY 1. PHONES ARE WEAK LINKS

It's as logical to bolt our front doors but leave windows open as it is to load PCs but not phones with antivirus software



JENS HEINEN

LEBOR SCHWEITZER

MANAL AL-SHARIF

MONA ELTAHAWY

MARIA POPOVA

DIEGO STOCO

M

ona Eltahawy rolled up her shirtsleeves and pointed at her left forearm. Under the skin, she said, are five screws and a titanium plate: the result of a beating by Egyptian police in the middle of the Arab Spring. Eltahawy, a journalist, was saved that day by Twitter. Arrested during clashes in Cairo in November 2011, she said she was sexually assaulted by a group of policemen and threatened with gang rape. Her phone was broken too, but at one point she managed to tweet her location from another prisoner's BlackBerry: "Beaten, arrested, Interior Ministry." Within minutes, the hashtag #Freemona was trending, and the US State Department had intervened - saving her, she believes, from further torture.

But don't be fooled, Eltahawy continued: Twitter is no substitute for real activism. "Last year it saved my life," she said. "But this year I almost gave up on it." She was referring to an incident that unravelled in September. In New York, the Stop Islamization of America group had rolled out a series of Islamophobic subway adverts. Eltahawy sprayed pink paint over one of them - "the least violent colour" - prompting her arrest, and a dual barrage of snark and apathy on Twitter. And that was when

Eltahawy, in her words, "hit the wall" with the network. "When a social revolution is face-to-face with you on the subway," she told the conference, "you have to go and meet it in real life, not on Twitter." The American political left, on the other hand, seemed to think that tweeting about it was enough. "When I move back and forth between the US and Egypt, I try to take the story back and forth to each one. I tell them, you must remember your history, the history that gave you the luxury to do this on Twitter. Because in Egypt bodies are being dumped inside trash cans."

Eltahawy is currently fighting two battles on two fronts. In America, she's targeting complacency. In Egypt, she is combating political oppression and, in particular, misogyny. When she went to hospital for treatment of her Cairo injuries, the doctors and nurses treated her as if the attack had been her own fault. "How could you let them do this?"

@IVANMAZOUR

Live hacking, a disabled man walking in an exoskeleton and someone who started his own religion. Best conference ever. #WIRED12

@D_CORNISH

So many speakers. So many ideas. I need a lie down.

one asked her. Shocked by the reaction from so many in the medical profession, Eltahawy is soon going to return to Egypt to lead a campaign against sexual violence. "We've removed Mubarak," Eltahawy said, "but he's [still] in our head. Mubarak is on our streets, including in the misogyny against women."

MONA ELTAHAWY

ACTIVIST AND JOURNALIST. DAY 2. OPPRESSION IS ALSO NONVIOLENT

The writer who was beaten and assaulted in Egypt during the Arab Spring found her enthusiasm for Twitter waning after a New York encounter



As a small child in India, Ramesh Raskar used to tinker around with a primitive camera. "I've come a long way," the MIT professor laughed. Forty years on, Raskar has invented a camera that can shoot film at a trillion frames a second.

"It's so fast you can see light in motion," Raskar said. To prove it, he flashed up a video of a Coke bottle. Travelling at glacier pace down the neck of the bottle was something that looked like a bullet: a bolt of light, moving at 300,000kps, but slowed down by a factor of ten billion. "If you let a

bullet go the same distance and slowed the movie down by a factor of ten billion, you'd have to sit there for a whole year," Raskar said. "It would be a very boring movie."

Yet femto-photography, as Raskar's invention is called, is far from boring. It gives us the ability to see round corners. If you fire a series of lasers into a room from a femto-camera, those lasers will hit whatever is lurking round the corner, rebound and eventually return to the lens of the femto-camera. The time it takes for the lasers to return reveals the shape of what's in the room – and how far away it is. Scientists could use the technique to

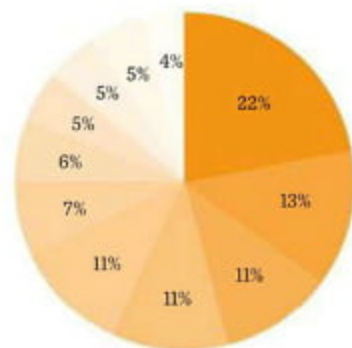
see what's hidden down deep recesses inside the human body. Firefighters could work out if anyone is inside a burning building, without endangering themselves in the process.

For Raskar, the invention isn't just a one-off. Among others, there is EyeNetra, an add-on for mobile phones, tests an individual's eyesight without the need for expensive equipment. Simply look at the app through a cheap rectangular eyepiece and you'll quickly discover your prescription. A similar test diagnoses cataracts.

Raskar has 40 patents. Where does he find the inspiration? Simple, he said: from a

thought construct he calls the "ideas hexagon" – six thought processes that reveal the logical next step in a project. One is inspired by the high jumper Dick Fosbury, who revolutionised his sport in 1968 by jumping backwards over the bar rather than forwards, as was traditional. It's a tactic we should all use, Raskar said. Take an idea, "and do the opposite."

**DELEGATES
IN NUMBERS**



- Media/publishing (22 per cent)
- Other (13)
- Did not say (11)
- Agency/marketing (11)
- Technology/innovation (11)
- Internet technology/web (7)
- Art and design (6)
- Finance industry (5)
- Public sector/education (5)
- Telecoms (5)
- Conferences (4)

RAMESH RASKAR

MIT SCIENTIST.

DAY 2. SEE AROUND CORNERS

The femto-photography pioneer explained how to innovate using a thought construct called an "ideas hexagon"



T

he voice of Mark Pollock boomed from a video during the final session of the first day: "The people who found me thought I was dead. The doctors thought I was going to die. When I knew what was going on, I wondered whether dying would have been a better outcome."

When the lights came up at the end of the film, the audience discovered that Pollock was not only alive, but sitting alone on stage in a wheelchair. WIRED editor David Rowan had announced that the conference was full of speakers with "a healthy disregard for the impossible" – and chief among them was Pollock. Once an international rower, he lost his sight at 22 – not that you'd know it from his CV. He went on to win two rowing medals at the Commonwealth Games. Then he started running marathons, including events in the Arctic and the Gobi Desert. In China, he ran six marathons in seven days. He was the first blind man in history to reach the South Pole.

Then, in 2010, tragedy struck again: Pollock fell from a balcony while attending the Henley rowing regatta. He was paralysed from the waist down. At best, doctors said he'd never walk again. He spent six months in bed, "hallucinating, slipping between reality and a dream state". In between doses of morphine, he was vaguely aware of messages from

friends that said: "Sorry to hear about your accident. But at least it's you. You'll be able to deal with it."

As it happened, Pollock's friends were right. He never gave up. Once he could leave hospital, he sought out therapists and scientists "who aren't scared to be wildly ambitious". He teamed up with the team behind Ekso Bionics, a Californian company that is pioneering work on exoskeletons. Pollock can now walk assisted by a battery-powered bionic device that straps over the user's clothing. He has also partnered with Project Walk, a charity that rejects the conventional wisdom that paralysed people can't rebuild the parts of their nervous system that lie below the level of their injuries. Pollock

MARK POLLOCK

ADVENTURE ATHLETE. DAY 1. DISREGARD IMPOSSIBILITY

The first blind man to reach the South Pole was later left paralysed after a fall – but inspiration followed

hopes that with the project's help, he'll be able to walk by himself again.

In fact, he wants to do more than that. "If you're going to say you'll walk again," Pollock said to the audience, "you might as well say you're going to run again."

@ORDERLYPRINT

Last wks #WIRED12 was the most inspiring event I've been to... if you can, go next yr! Science, music, creativity, with technology as focus



THE WIRED 2012 INDEX



Number of book deals Tumblr has generated, according to David Karp

39%

Proportion of delegates at level of board, C-suite, founders, directors, presidents and VPs

561

Number of delegates at The Brewery, London EC1, over the two-day event

60,000

Number of extra people who turned out to vote in the 2008 US presidential election, then in turn induced an additional 280,000 people to vote "because of this weak little post on their Facebook page", according to Nicholas Christakis

1 TRILLION

Number of frames per second taken by Ramesh Raskar's femto-photography camera that his team built at MIT

INNOVATION

The most popular answer from delegates, when asked at registration for their current obsession

£7.1 BILLION

The price for which conference speaker Mike Lynch sold Autonomy to Hewlett Packard in October 2011

THIRTY-ONE

The number of countries represented by delegates at this year's conference

SEE AND HEAR THE
WIRED2012 TALKS
AT WIRED.CO.UK/12



WIRED2012 may be over but it lives forever online. wired.co.uk/12 is the home for everything you may have missed: the talks the speakers gave – all in high-definition video; the live wired.co.uk podcast recorded with David Karp and Lily Cole; as well as the comprehensive reports from the show floor.

ADDITIONAL RESEARCH: MIV

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FETISH

OBJECTS OF DESIRE
THIS MONTH: 01.13

- ALUMINIUM AUTO
- SMART EBIKE
- ENGINE-PARTS AUDIO
- LUXURY BOATING
- COLD-WEATHER KIT

EDITED BY JIM HILL

The fabric roof can
be fully deployed
in just 12 seconds



LIGHT RACER JAGUAR F-TYPE

Jaguar's first all-aluminium sports car has the same growl as the classic E-Type, but a far tamer fuel consumption.

By avoiding steel it has kept the weight to just 1,597kg. This basic V6 model is rated at a commendable

11.12kpl and 209g/km CO₂ emissions, with a top speed of 260kph. Upgrade to the V8 to hit 300kph. £58,500 jaguar.com

FETISH



The lithium-ion battery can be removed for indoor charging

A USB port and cradle lets you use a smartphone for satellite navigation

CLEVER COMMUTER

SMART EBIKE

Smart's green and white electric-drive cars have been joined by similarly styled ebikes that will give you an extra 100km of emission-free commuting. You can

assist the 200 Watt BionX electric motor in the back-wheel hub by pedalling, and top up the battery through energy recovered when braking. A carbon belt

in place of a chain helps make keep maintenance low. An LCD panel controls the LED lights and displays scrolling battery and trip data. £4,459 smart.com

EXHAUST-PIPE IPHONE DOCK

IXOOST OT

An iPhone/iPod dock made out of sports car exhaust pipes? That'll be the iXoost. Available in eight, ten or 12-cylinder configurations, the model below is the

eight-cylinder/four-horn version. The dock channels audio through the engine piping to four 70W treble and midrange cones and a 140W subwoofer. The heavy

hardware provides very stable bass. Its recycled parts and manufactured pieces are all sourced and assembled by hand in Modena, Italy. From €5,000 ixoost.it

With the iXoost app, you can simulate a Ferrari engine sound

This exhaust was once part of a 2007 Ferrari F1 engine

FETISH



SLEEK AND SPEEDY

PERSHING 82

Pershing is known for its powerful yachts, and its latest craft uses a pair of coupled V16 engines and surface propellers to thrust this 25-metre-long, five-metre-wide boat along at 80kph. Its hydrodynamic hull design also helps

the vessel achieve a 550km range. If the speed of this craft doesn't attract admiring glances, the retractable platform that provides an extended Sun deck probably will. €4,780,000 pershing-yacht.com



FISHING INSPIRED

MOCHI DOLPHIN 64

Mochi's designers and architects have taken the traditional hull shape of a lobster boat and added a dash of technology and Italian styling. The 20-metre fibreglass hull is highly manoeuvrable,

especially with twin V8 engines at your disposal, giving a top speed of 60kph. The steering station is located amidships, under the mast, for an unobstructed view of the open seas. €2,550,000 mochicraft-yacht.com

HIGH-SPEC ON THE HIGH SEAS

LUXURY BOATS AND YACHTS FOR OCEAN-GOING OLIGARCHS



OCEAN OBSERVER

FERRETTI 870

Studio Zuccon International Project and Ferretti's own Advanced Yacht Technology R&D facility have incorporated striking features such as a fully-glazed main cabin that gives a 360-degree view in

this 26-metre yacht. Large windows in the hull allow light to flood into the lower decks and give a thrilling view of the boat's wake as its two V12 engines churn up the water. €4,600,000 ferretti-yachts.com



OPEN BOATING

CRN DISLOPHEN 62

The Dislophen's heavy hull remains below the waterline, like a displacement yacht, but its extensive outdoor space makes it look more like an open boat – hence the rather odd name. Its five VIP cabins each have en suite

bathrooms, and there is ample entertaining space indoors and on deck (helicopter allowing). With two Caterpillar C32 engines, this vessel is quite capable of crossing the Atlantic. £750,000 crn-yacht.com

NEW-WAVE DESIGN

RIVA ISEO

The Iseo's tapering lines and shimmering mahogany draw unmistakably on Riva's Mediterranean heritage. But it's also the Italian brand's first boat designed

to incorporate an infotainment system you can control from an iPad. The on-board music system syncs with iTunes for AirPlay streaming and the GPS charts

are built for the iPad's Retina display. This model is diesel, but a planned hybrid-electric drivetrain version will allow for silent operation. [ETBC riva-yacht.com](http://ETBC.riva-yacht.com)



The eight-metre-long boat has a retractable soft-top roof in the rear

The high gloss finish is achieved by applying 20 layers of varnish

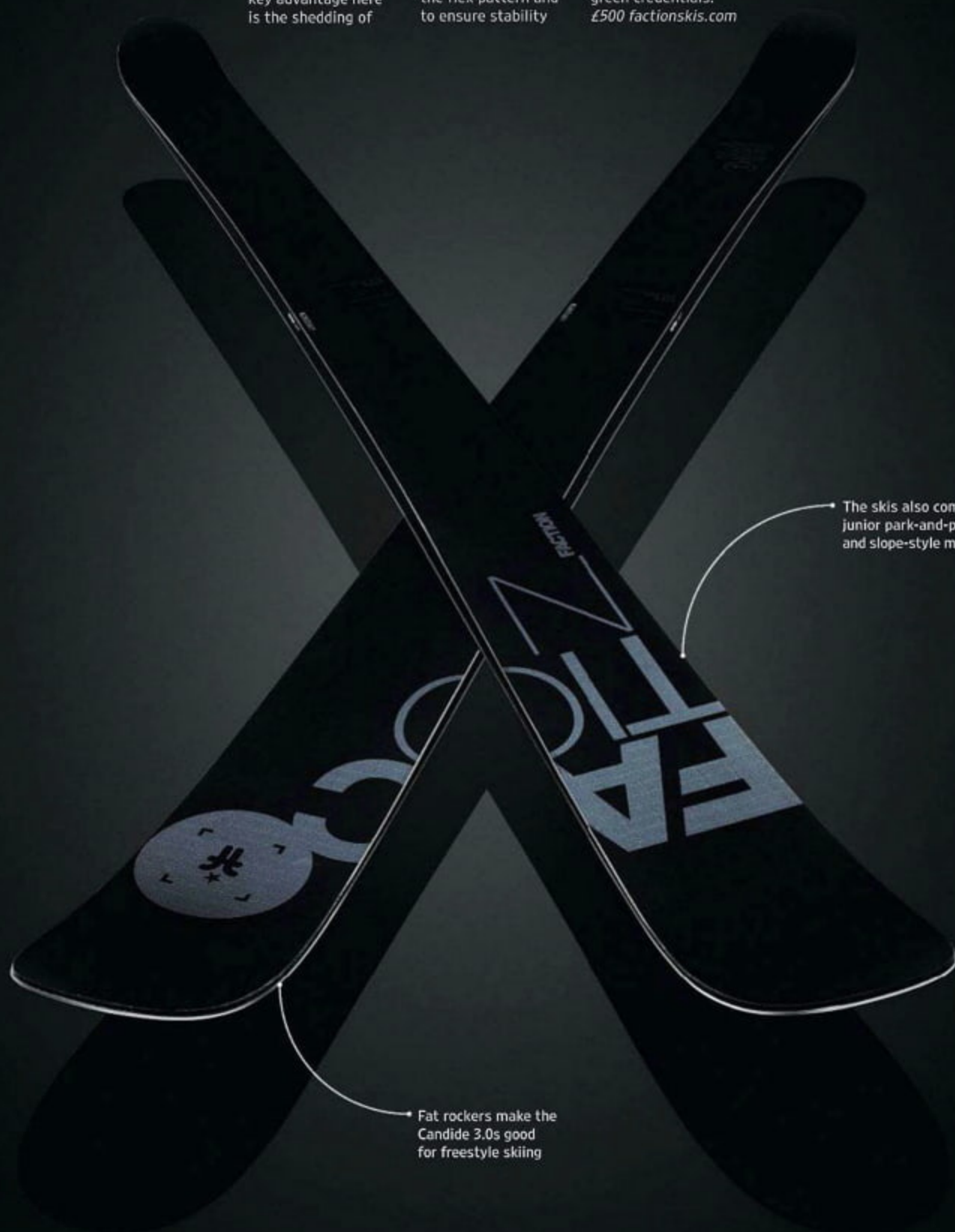
GREEN SKIING

FACTION CANDIDE 3.0

Faction's super-light skis swap the usual wooden core for one made from recycled plastic. There's an environmental benefit, but the key advantage here is the shedding of

800 grams from its wood-core equivalent. Faction worked closely with world-champion skier, Candide Thovex, to refine the flex pattern and to ensure stability

and responsiveness. The use of natural flax fibre instead of fibreglass for the outer part of the ski further reinforces the Candide 3.0's green credentials. £500 factionskis.com



The skis also come in junior park-and-pipe and slope-style models

Fat rockers make the Candide 3.0s good for freestyle skiing



EXTREME JACKET

MOUNTAIN HARDWEAR

This quilted jacket arrived vacuum-packed in a thin envelope – open it up and it expands out to a full-size jacket weighing just 205g. The ripstop fabric shell is filled with just enough high-grade 850+ fill down

to provide a useful level of insulation in sub-zero conditions. Elastic cuffs and a drawstring waist help to keep out those icy breezes. It'll also scrunch down to fit in a small backpack pocket. £215 mountainhardwear.eu



FETISH

CARBON-FIBRE AXE

BLACK DIAMOND COBRA

This carbon-fibre ice axe is ideal for leashless mixed, ice and alpine climbing. The advantage of the carbon-fibre shaft is its lighter weight – meaning more precise swings without sacrificing balance.

The remaining heft is concentrated in the head of the axe, to ensure solid strikes. Carbon fibre is also excellent at dampening vibrations, so wrists are protected from impact shocks. £250 snowandrock.com

ANTI-FREEZE EQUIPMENT

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SNOW SIGHTS

MINOX BN 7X50 DCM

These powerful binoculars offer 10x magnification, but add only 780g to your pack weight. The white colour scheme makes them suitable for hunting during winter. Designed in conjunction with Volkswagen, they are

rugged, waterproof and can operate at temperatures of around -10°C. And, in case you lose your bearings during a white-out, the in-built digital compass will help get you back on the map. £TBC minox.com



CHAT AS YOU SKI

BUHEL G33 GOGGLES

These high-end ski goggles use a bone-conduction microphone integrated into the frame to pick up your voice directly through your nose's vibrations. This removes wind-noise issues typically

associated with using external mics during skiing. The goggles connect with your phone via Bluetooth, and an "intercom" feature let you chat (or trash-talk) to other G33 wearers nearby. From €279 buhel.com



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IDEAS BANK

BRAIN FOOD AND PROVOCATIONS THIS MONTH: 01.13

NIC MARKS_JULIA HOBSBAWM_TRACEY FOLLOWS_RYAN W BUELL & MICHAEL I NORTON_NATHAN EAGLE

NIC MARKS_

Your boss's first duty: to make you happy



Happiness and work. The two words don't seem to sit well together. Work is about the stuff we have to do. Work is tough. Happiness, in contrast, is about fun things. Happiness is light. Happiness is even a bit soft and fluffy. So perhaps it is not surprising that people's happiness at work is not taken that seriously by organisations. But I want to explain why this is a serious business mistake and a serious misreading of what happiness is really about.

Happiness is essentially an emotion that we experience and, like all emotions, it has an evolutionary purpose. Anger and fear are central to the fight-or-flight mechanism that has helped us survive and thrive over the millennia. So what is the evolutionary purpose of happiness? Barbara Fredrickson and colleagues at the University of North Carolina have shown from more than a decade of lab-based research that happiness is about creating and responding to opportunities. She calls this the "broaden and build theory" as the experience of happiness enables us to broaden our range of possible responses to situations and over time helps build our confidence and skills. For example, if we smile, it opens up the possibility of an interaction with someone, as a smile is a signal

that we can be approached. Over time this builds functional relationships. When we are in a good mood, not only do we smile more but we can also literally see more – our peripheral vision is enhanced. So when you are in a restaurant and you can't get the attention of a grumpy waiter, it might not be that he is ignoring you, but that he physically doesn't see you. He is not scanning the horizon for opportunities, which results in poor customer service.

But there is a further benefit of happiness that might be even more impactful in helping businesses survive and thrive. Happier people and happier teams are more creative. In her research, Fredrickson looked at how teams functioned in business meetings. She observed that high-performing teams were characterised by much more positivity as well as being more inquiring and innovative. This particular piece of research can claim only to show that high-performing teams are happy. It does not say anything about causality (does high performance create happier employees or vice versa?). Researchers at Gallup have, however, looked at this relationship between

employee perceptions (related to what I would call happiness at work) and performance. Using data from more than 2,000 teams with 150,000 members, it showed that both pathways exist but that the impact from happiness at work to performance was twice as large as the other way round. In other words, happiness at work directly leads to higher performance.

What these pieces of research suggest is that businesses should be taking happiness at work more seriously. Of course, this poses the question of how to do this. You can't just tell people to be happier.

Daniel Pink, the renowned business author, has noted the irony that in a feedback-rich world the workplace is "one of the most feedback-deprived places" in modern civilisation. This is where people in my trade – researchers and statisticians – can help. But we can't just publish technical papers or reports that almost require a PhD in statistics to read. Instead we need to create tools that support and inspire people. One idea we have developed is a happiness-at-work-survey tool that mimics the human emotional-feedback system. Standard staff engagement surveys are themselves pretty disengaging, so we are aiming to create innovative and engaging tools that provide instant feedback, enabling individuals, teams and organisations to develop together in becoming happier and critically more functional. In this way we hope to convince the business world that the words "work" and "happiness" do go together.

Nic Marks is the founder of the Centre for Well-being at the New Economics Foundation, London. The survey is free to take at happinessworks.com



JULIA HOBBSBAWM.

Sweep aside the red rope for open-sourced elitism



For six weeks this year you could have taken a Princeton course in Algorithms, Part I with world-renowned professors. The course's cost? Plugging in a computer, or an investment of two weekly sessions of 75 minutes per week. Two thou-

sand Google+ users recommended this particular free course, run by the social enterprise Coursera. It has nearly 1.5m online students. That's a big classroom.

Of course, to attend Princeton in person is a different matter. You would need money and you would also need to be selected. Elite institutions make you wait to see if you have been chosen because marketing law is clear: the more elusive something expensive is, the more desirable it becomes.

Elitism in education, ideas, fashion, culture and politics is still everywhere. Human nature craves being found special and being chosen. When you stand in line at a club and the bouncer sweeps aside the red rope to let you in, you are participating in a ritual of selection which is as old as history. Unless you are a very rare human, I expect you participate in some kind of elitism yourself. I know I do: we all love an upgrade, after all.

The old-style elitism of small, invitation-only "behind the red rope" groups and networks is growing. Gathering offline somehow makes sense of the sensory overload the internet era has brought with it. We hunger for open access to every bit and byte of knowledge, but also for intimacy.

Welcome to open-sourced elitism, where people go online to learn and share in big numbers, but also go offline in smaller, personalised and curated ones.

This play on dimension and scale is interesting because the content is similar, but the format is strikingly different. TEDTalks has made a virtue of showing practically unedited footage of the "live" experience of its speakers online. Footage of food campaigner Tristram Stuart railing against supply-chain waste in front of 200 people – myself among them – at London's Unicorn Theatre for a niche TEDGlobal invitation-only event has been downloaded around 120,000 times.

The scale and equality of the internet is offset by the rise of the immersive, niche experience. The *Here On Biz* app operates on LinkedIn's API to connect any of its millions of members who happen to be in a small area, such as an airport or city, with each other. The app's cofounder Nick Smoot says it is "a move away from the Walmart model to the farmers' market. People want their networks made locally, and with a hand-matched element." Or to put it another way: you may have a lot of Facebook friends, but you want, and indeed can see, only a smaller number face-to-face at any given time.

Geography will become less of a barrier to accessing information. Padasree Warrior, CTO and chief strategy officer of Cisco, talks of its new focus on "bring your own device" technology for today's workers who need to network anywhere, not just in the office.

But people's preferences are still going to oscillate between the vast, open-access web-based kind and the highly niche, where scale is valued for how few are involved and not vice versa. Path, Branch and Best of all Worlds are some of the new generation of social networks that have the idea of exclusivity and elitism embedded at their core. They reflect what we know. We want to swim in the vast ocean of information and intelligence but we don't want to drown in it. We want and can have the best of all worlds now.

Julia Hobbsbawm runs *Editorial Intelligence* and is honorary visiting professor in networking at Cass Business School, London. editorialintelligence.com



TRACEY FOLLOWS.

Uselessness still has its uses in our digital world



If there was a digital version of Bullshit Bingo, most people would have the word "utility" on the top row. It's not that utility isn't important, valuable or even aspirational; it's just that the very concept has become so over-used that, ironically,

it no longer seems of much use. Digital has given rise to personalisation and the disintermediation of many of our ways of working, learning, purchasing and communicating. In doing so, it has led to utility taking on cult-like status.

Like any kind of fanaticism, the issue is not the concept itself but the fact that it's been blown out of all proportion. I'd like to argue for a readjustment (or at least a fair hearing) for things that aren't these days considered to deliver utility. Let's make some space for what is apparently useless.

There are plenty of everyday things now considered to possess no utility because they're not digital: the lead pencil, the clocking-in card, the landline, the classroom blackboard, the newspaper or, indeed, any paper-based book. But the tyranny of utility doesn't apply only to physical objects – it's entered education. An excellent example is the letter Ted Turner's father wrote to him when he announced his desire to study Greek at university. Turner Senior's tirade against his son's decision to pursue an apparently "dead" language echoes today's infatuation with computer language: perhaps English will also be seen to be redundant once we're all fluent in the global language of code.

An even better example was cited by social psychologist Karl Weick in a 1996 interview in *US WIRED*. Weick used an example from the first Gulf war: despite having a sophisticated PC-based system for logistical operations, William "Gus" Pagonis, who was in charge of logistics for the US Army, was reported as saying that requisitions were actually made using 12cm x 7cm cards. According to Weick, although the cards didn't have utility in the sense of speed or storage, they were easy to complete, distribute and discard once requisitions had been fulfilled. He explained: "You never know what is going to crop up next, so

you ought to have some things in the system that, given your current problems, are useless."

Early in 2012 Amazon was widely reported to be planning to launch bricks-and-mortar stores. How quaint. The company has trained us to believe that physical stores are useless, but now they apparently have a new-found utility. In my field of work there is momentum gathering around the supposed uselessness of advertising, especially television and print. This is partly to do with the fact that not every last pound of an ad campaign can be measured and its effectiveness accounted for.

Strange, then, that TV spend is still high and big brands continue to spend on traditional media. If the utility cult is to be believed it would be more efficient, and possibly even more effective, to switch to digital. In reality, television advertising is as popular as ever: TV advertising revenue in the UK reached a record high of £4.36bn in 2011.

Frank Abagnale, whose story was told in the movie *Catch Me If You Can*, gave a talk at SXSW this year. Abagnale - who bypassed paper-based, human-centric processes at Pan Am and fraudulently posed as a pilot for several years - was asked if he would have got away with it for so long if he had been cheating the system today. "It would be 4,000 times easier to do now," he replied. "Technology breeds crime."

Utility has come to describe a system that can be enthusiastically over-engineered to the point that it loses all empathy. The trend is to see utility as cool, partly because it is so cold and emphasises the rational, efficient, logistical and invisible. But what's seemingly useless can often prove to be the key required to unlock a new problem. Oh yes, there we are: keys. They have no utility in the era of electronic cards, mobile-phone swiping and gesture control, but they're heavy and noisy - and I always know where they are.

Tracey Follows is chief strategy officer at JWT London



MICHAEL I NORTON & RYAN W BUELL_

You are 3% of your way through this article



he website for the United Parcel Service receives 32 million package-tracking requests per day. That's more than two for every package they ship. Clearly, people hate waiting - just think back to the last time you suppressed the urge to hit your computer while staring at an endlessly... loading... progress... bar.

Not surprisingly, companies have responded to our wait hate by speeding things up whenever possible: faster search, faster shipping, faster service. But speed can sometimes backfire: when we get what we want too quickly, we can feel that the company didn't really do that much for us - leading us to question why we're paying so much for something that took so little time and effort.

A better way to cope with customers' demand to know what's taking so long is not to reduce their wait, but instead

simply show them what is taking so long. Our research demonstrates that when people can see the effort expended on their behalf in the delivery of a service - what we call operational transparency - they not only mind waiting less, but actually value the service more.

We created a fictitious travel website and asked people to search for a flight from Boston to Los Angeles. Some people saw a typical progress bar, but others experienced operational transparency: the site revealed each airline as it searched it - "Now searching delta.com... Now searching jetblue.com..." - while creating a dynamic running tally of the most affordable flights. Even though everyone then received the same list of flights and fares, those who experienced this transparency rated the service much more highly.

And when asked to choose between a site that delivered instant results or one that made them wait but showed its work, the majority of people chose the site that made them wait - even when they had to wait for a full minute.

Have you ever waited forever for a meal to arrive, only to find that the food is cold and the chips soggy? Maybe they've been working hard in the kitchen, but in cases where the result is disappointing, our research shows that transparency

can have the reverse effect: You did all that work and this is the best you can manage?

We created a dating website and asked people to search for prospective soul mates. We informed some people that we'd found very attractive results – and showed them alluring photos of their future paramours – but told others we'd only managed to find less comely (though equally compatible) options. Those in the latter group liked our service less the longer it worked for them.

Transparency is a built-in facet of many face-to-face service experiences. We watch as cashiers count our money at banks or scan our items at supermarkets, but in a digital economy customers are often separated from the people and processes that deliver value to them. Several companies are bucking this trend by bringing transparency online and acquainting customers with their operations.

Consider an innovation in the comparatively low-tech world of pizza: Domino's Pizza Tracker, used by 75 per cent of the company's online customers to monitor their dinner's progress from order to delivery. (You can even learn the names of each employee who preps, bakes and delivers your order.) AT&T relies on a clever use of audio to signal effort: when customers call the automated help line to recharge their calling cards, they hear the sound of fingers typing on a keyboard – triggering a vision of someone working on their behalf. Americans tired of waiting for the economic stimulus to kick in can visit recovery.gov to track exactly how the United States government is putting their tax dollars to work.

In short, people might not hate the wait as much as they think. We can learn to love to wait, as long as we're shown all the wonderful things happening on our behalf while we do.

Ryan W Buell is an assistant professor at Harvard Business School. Michael I Norton is an associate professor at Harvard Business School and co-wrote the forthcoming book *Happy Money: The Science of Smarter Spending*

NATHAN EAGLE

Dumb phones are the future of advertising



That old mobile phone that most of us have sitting in a drawer somewhere might matter more for global economic growth than the new iPad or iPhone.

Sure, "dumb" phones don't let you download apps, post video or locate your friends. You can't send email or check the hourly local weather. But, just as 20 years ago when basic mobile phones made it possible for developing markets to leapfrog 50s wire lines and go right to 90s-style communication, today they're going to help those markets leapfrog 20th-century broadcast advertising and go right to today's targeted marketing. And that will transform the way hundreds of billions of pounds in emerging markets are spent.

The first reason plain old mobile phones have this power is that they have become ubiquitous. In a world of seven billion people, there are six billion mobile-phone subscriptions. In Colombia, Egypt and Indonesia, the mobile penetration rate has surpassed 90 per cent; in Brazil, Russia and Vietnam, it's more than 100 per cent. Even households that don't have electricity often have mobile phones, with pay-per-use mobile recharging stations becoming increasingly common.

The second reason dumb phones are so potent is that mobile-phone minutes cost more, relative to income, in emerging markets. As a result, precious airtime is becoming a currency – and phones are becoming devices not just for communi-

cation, but for compensation. This is the opportunity our company, Jana, is going after. Suppose you just tried some new soap in Bangalore. As a reward, you get 50 rupees (58p) of airtime transferred to your handset. Filled out a mobile consumer survey in Shanghai? Get 5CNY (49p) of airtime, within seconds. Just reading an ad can be a transaction. Our report, *Engaging with the Next Billion*, reveals that 74 per cent of mobile users in Brazil say they are happy to get advertising on their phones in exchange for free airtime minutes.

Companies are catching on. In the last year, brands such as P&G and Unilever have launched "mobile credit" campaigns, offering local currency credited directly to the phones of the consumers who try their products. And it works: this year we helped Danone double its sales of bundled yogurt in Indonesia by providing airtime discounts to its consumers. As a result, consumers can increasingly be served and addressed in the kind of customised way we're used to in the west. Dumb phones are essentially enabling the targeted e-coupon in the huge swathes of the world with neither deep smartphone penetration or Sunday circulars.

That means big changes in global commerce. Multinational companies spend almost £125 billion a year in emerging-market advertising. But through mobile phones, they can spend that money in a more targeted way, resulting in the jump in advertising efficiency that Western markets achieved in recent decades.

In fact, dumb-phone marketing will not only increase ad spend efficiency in emerging markets, it will also boost consumer spending power. The average annual income of a middle-class consumer in emerging markets is £1,250. If even half the £125 billion spent on advertising in those markets were redirected from the billboard owners, who get most of the advertising revenue now, to consumers, through their phones, a billion emerging-market consumers would get the equivalent of a five per cent raise. Better products, more disposable income. That's a win for commerce in every direction.

This is the second communications revolution creditable to no-frills mobile phones in the last 20 years. Some technology is smarter than it looks.

Nathan Eagle is the CEO of Jana and an adjunct assistant professor at Harvard University. jana.com



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INCONCEIVABLE

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The 100% electric Nissan LEAF. Nissan. Innovation that excites.



Figure is based on a price comparison. The average price of a gallon of petrol is £6.315 (as quoted in the AA fuel price report, October 2012). The cost of powering the LEAF for one mile is 1.86p, based on a national average. So, for the same price as a gallon of petrol, the LEAF can be charged enough times to be driven 339.5 miles. By texting your average daily journey, Nissan will provide an SMS response with details of the savings. Maple Cross, Rickmansworth WD3 9YS.

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PLAY

WIRED CULTURE

THIS MONTH: 01.13
IVES BÉHAR'S OUYA
THE FLYAWAY GALLERY
DIY WILDFIRE WORLDS
EDITED BY TOM CHESHIRE

KONG GETS CHIPPED

Viral hits don't usually stick around for long, but two artists have created blog-bait that will take 18 months to complete in a wood-print studio in Toyko. So what were the origins of this rather familiar-looking scene? →



"In April, I decided to do an art project specifically to get a lot of attention," says Jed Henry, an illustrator based in the Rocky mountains. He started reimagining video games in the style of Japanese woodcuts, under the name *Ukiyo-e Heroes*. Each week, he created a new design and posted it on Facebook. Blogs such as *BOING BOING* picked up Henry's work - and it soon "blew up". "I'm not cut out for the fast-paced viral life," Henry says. So last August he teamed up with Bull, a print-maker based in Tokyo, to turn the designs into traditional-looking hand-made woodcut prints, with help from a Kickstarter.

"On the internet, things happen so quickly. Kickstarter campaigns happen instantly," Bull says. "But good cooking takes time. There's no scaling involved here. I can't hire more printers. We were really worried that people wouldn't be willing to wait 18 months for these prints. But they went along with it." To produce 400 prints of one scene takes Bull's workshop two months; Henry and Bull will deliver the last set of their *Ukiyo-e Heroes* series in August 2013.

Their next project is based on the manga books of Hokusai: "They're full of these little vignettes of things like sumo positions," Henry says. "They mirror what video game manuals look like - they look like moves

in a fighting game." **TC mokuhan.com/heroes**

Below: Fox Moon; previous page: Barrel and Hammer



Crowd gaming

Jambox creator Yves Béhar is opening up the console industry - with a little help from his 63,000 backers

Yves Béhar is used to designing disruptive products, whether they're high-end Bluetooth headsets or £120 laptops for the developing world. But now he's working with 63,000 people. His latest project, Ouya, an open-source, Android-based gaming console that will cost just \$99 (£60), launched as a Kickstarter pitch in July with a goal of \$950,000. It raised \$8.5 million.

"Gaming has a very passionate community, it thrives on innovation, change and provocation," says Béhar (pictured). "With the Kickstarter pitch, we were doing \$20,000 every six minutes, and a third of backers left a comment - we got 21,000 of them." Some of these comments helped inform the design: the Ouya controller's four buttons, for instance, spell out the console's name, after it was suggested by a commenter. This open attitude suits Béhar's approach to the console. "I designed the console and its user interface more as a canvas for other people's creativity than an overbearing, 'We own this, we own you' kind of attitude."

Béhar is betting the open platform can disrupt an entire market. "The way the gaming industry is set up is not that different from the movie studios of the 40s and 50s - captive talent, captive audience. There's a very predictable set of games," the 45-year-old says. "At the same time, there's all this talent - indie developers and young kids that want to hack games. It's like the time when indie films started to come along out of a need for new expression in an art form."

Business matters to Béhar; he's not just designing the Ouya, but backing the company, too - as part of the Design Ventures arm of fuseproject, the studio he founded in 1999 in San Francisco. Each week, the studio looks at four or five companies' proposals; it picks around four entrepreneurs to work closely with from the early days of a company. Béhar says he has three criteria for a collaboration: design must be a large part of the value that fuseproject can create for a company; he needs to like the entrepreneurs ("We're going to be spending a lot of time together"); and the company must have the potential to disrupt an existing market, or create an entirely new one. Design Ventures also offers a new business model for a studio: fuseproject takes an equity stake in



the businesses with which it partners. Béhar's first venture was in 1999, a time when the startup world didn't have much time for design. "Today, if a startup does not have design as one of the founding principles, it has much less chance of being backed," he says. "Good design accelerates the adoption of new ideas, and startups are new ideas." [TC fuseproject.com](http://TCfuseproject.com); ouya.tv

■ Béhar with an Ouya console: "A long way from the over-designed products that already exist"

THREE BIG IDEAS

Yves Béhar's fuseproject studio has been disrupting the world of design since its launch in 1999. Here are three of its most iconic products.



ONE LAPTOP PER CHILD XO LAPTOP
Low-cost PC conceived by Nicholas Negroponte



GE WATTSTATION CHARGE POINT
Easy-to-use charger for electric vehicles



PUMA'S CLEVER LITTLE BAG
Uses 65 per cent less card than a regular box



MUSICAL TELEPATHIC MASHUP

"I thought it would be fun to set up a situation of cause and effect, where a concept is causing a musical outcome," says Drew Daniel, one half of experimental duo Matmos. Along with his other half – both professionally and personally – MC Schmidt, he has been making music for more than 20 years. Their latest project is split across an EP and album – both conceived by a version of the ganzfeld experiment, a sensory-deprivation test used in lab studies of extra-sensory perception.

For four years, the pair have been conducting telepathic experiments in which Daniel attempts to transmit a concept to a subject. The opening riff and the title of their *Large Green Triangles* EP came from one test.

Whether the finished concept was an accurate reading of what was being transmitted, we will never know. Daniel resolves "to preserve a certain integrity of process, so I didn't tell anyone whether it worked. That felt like a cop-out – like I wasn't doing the science part. I was doing the art part." Ailbhe Malone
The Marriage of True Minds is released in February 2013



ATWOOD'S NEW PLOT

Margaret Atwood's writing tools are as forward-looking as her books. In 2006, the Booker Prize-winning author of *The Handmaid's Tale* developed and launched the LongPen, a remote-signing device; she has thrown herself into Twitter, where she has nearly 350,000 followers; and she shares her work with millions on Wattpad. But her latest project, Fanado, is her most innovative yet. An evolution of the LongPen, it is "the promotional tour online" and aims to change the way fans interact with artists. An author will be able to offer readers a one-to-one video chat or a book signing; a band could give a backstage video tour or allow fans into the studio. Currently in beta, Fanado has raised \$94,995 (£59,000) on funding platform Indiegogo and LA band 8mm and British author Naomi Alderman are signed up.

"I'm not a coder or a programmer," says Atwood. "I'm an originator, and I've given up a lot of time to it." But Fanado isn't just for professionals: "Anybody can use it - you can sign up and do a single event," she says. "It's like having a cable-TV channel - you can do the programming, archive it and YouTube it."

And what about a fan hoping for more intimate parts to be signed? "It doesn't usually happen to authors," she says. "But I did sign somebody's tummy once." Literary Chatroulette? Yes, please. Alison Flood fanado.com

PLAY FILM

Reds remade

An art collective's film aims to subvert the digital revolution via the Soviet era

On the border of eastern Austria, the last Soviet republic still stands: the microstate of Soviet Unterzögersdorf. A UN peacekeeping force patrols the DMZ between the two countries, but Unterzögersdorf has been declining economically and politically, and recently a bomb blast pushed it to the centre of a geopolitical struggle. The state is of course fictitious: monochrom, an "art-technology-philosophy group" based in Vienna, invented it in 2001. "We wanted to deal with the history of Europe, Austria, the failed utopia of communism and this odd nostalgia for communism," says Johannes Grenzfurthner, who founded monochrom in 1993 as a bulletin-board web fanzine. He based it on the real town of Unterzögersdorf because it had been in Soviet-controlled Austria from 1945 to 1955, and his grandparents lived there.

In 2001, he offered a package trip: those who took the 25-minute bus ride from Vienna were met by "Soviet officials" with Kalashnikovs in a town draped in USSR regalia. The next year, monochrom returned with the Hyper Hegel: a wood-fuelled supercomputer that played Tetris. "We're using the Soviets as a metaphor for talking about technological innovation," Grenzfurthner says. Now the state is coming to

On the border of eastern Austria, the last Soviet republic still stands: the microstate of Soviet Unterzögersdorf. A UN peacekeeping force patrols the DMZ between the two countries, but Unterzögersdorf has been declining economically and politically, and recently a bomb blast pushed it to the centre of a geopolitical struggle. The state is of course fictitious: monochrom, an "art-technology-philosophy group" based in Vienna, invented it in 2001. "We wanted to deal with the history of Europe, Austria, the failed utopia of communism and this odd nostalgia for communism," says Johannes Grenzfurthner, who founded monochrom in 1993 as a bulletin-board web fanzine. He based it on the real town of Unterzögersdorf because it had been in Soviet-controlled Austria from 1945 to 1955, and his grandparents lived there.

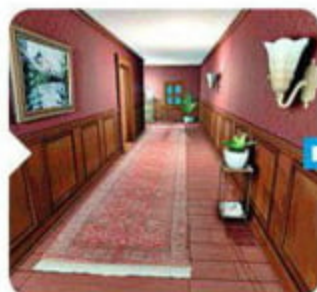


PHOTOGRAPHY: ALEXANDER BABIC
ILLUSTRATION: ROBIN BOYDEN

the big screen to explore issues of copyright, surveillance and the digital revolution. *Sierra Zulu* is a black comedy featuring cosmonauts, killer robot drones and Steve Wozniak, and shooting starts in January. But isn't film a bit traditional? "The stuff we were talking about suddenly became mainstream," says Grenzfurthner. "So we need a mass-medium propaganda tool." Forward, comrades! **TC** monochrom.at/english

MONOCHROM IN COLOUR (AND B&W)

1. Frank Apunkt Schneider 2. Roland Gratzner 3. Evelyn Furlinger 4. Franz Ablinger 5. Johannes Grenzfurthner 6. Günther Friesinger 7. Harald Homolka List 8. Daniel Fabry 9. Anika Kronberger



GAMING THE 90S

Game developers Steve Gaynor and Karla Zimonja worked on *Minerva's Den*, a game set in the fantastic, retro-futuristic undersea city of Rapture, home of the *BioShock* franchise. Now, at their indie startup The Fullbright Company, they are building a game set in a yet more inexplicable environment: the 90s.

"We wanted to pick a time without mobile phones or home internet, so all the clues could be artefacts – receipts and notes people left for each other," explains Gaynor, 30. "But we didn't want to go so far back that we lost the personal connection."

In *Gone Home*, the player investigates a suburban home in Oregon (where The Fullbright Company is based), piecing together what happened to its missing inhabitants. Zimonja, 35,

found design inspiration in the American consumer's Bible: "We got a Sears catalogue from 1992 on eBay, full of ghastly furniture. We scanned things from that and then Kate Craig, our environment artist, turned them into 3D models." Gaynor adds: "The core lies in a place that feels familiar and believable. It's all about being immersed in the atmosphere." *Gone Home* will be released in 2013 for PC. Daniel Nye Griffiths thefullbrightcompany.com

■ *Gone Home* is in the new wave of first-person exploration games

■ The setting is a mysteriously empty suburban family home

■ Clues explaining events are dotted throughout the house

■ At the centre of the puzzle is the family who live in the house



"CALL ME MAYBE" "GANGNAM STYLE"

SPOT THE ÜBER-MEME

"Call Me Maybe" and "Gangnam Style" have inspired countless tributes. But only one internet meme has been given both treatments: the 2004 film *Downfall*. **TC**

SimRiots and AI unrest

Bring chaos to toytown via a playable psychology experiment

If your favourite part of *SimCity* was raining apocalyptic destruction upon your metropolis, you'll like *Wildfire Worlds*. "The idea was, you create this twee thing, then fuck it up," says James Boty, creator of the indie video game that emerged from a combination of a "deep-seated desire to ruin the civilised world" and watching the 2011 London riots - "you just saw it spread".

In *Wildfire Worlds*, players start the game with a picturesque, paper-craft city, with pixellated figures going to work and minding their own business. Drop some activists on to the map, though, and chaos ensues: riots break out, the police arrive and buildings are set on fire. When the power lines are cut, the streetlights go out and the city is eventually reclaimed by nature. "The opening levels are a riot: it's 'destroy London'," Boty says. But later levels cover the spread of other things: disease, peace and ideas. "There were always going to be other elements. We originally called it 'the propagation engine' - it can be about the spread of anything. It's about the psychology of society."

The game relies on AI to run the thousands of characters, all with their own quirks: office workers (pre-riot) go out each day for lunch; if it's sunny, they head to the park but may not come back. The flat cardboard aesthetic - adopted by Boty after he began building cardboard models in his Soho offices - helps reduce the processing burden. A beta version is available, and is constantly updated; Boty plans to let gamers vote on new maps. "I'd love to model a large part of London this way. And then do Moscow, then Damascus." Eventually, he plans to release an iPad app. "It will be the thinking man's *Angry Birds*." **TC** wildfireworlds.com



■ Boty was used to creating cardboard mock-ups from his work in animation



■ Users can set the game's AI so that ideas and actions are more "contagious"



IT'S A 16-BIT SCULPTURE



Crate was intended to be the height of an average male

From afar, Conall McAteer's pixelated sculpture, *Crate*, looks as if it's been transplanted into the real world from a low-resolution video game. Up close, it's a 1.83m³ wooden crate painstakingly cobbled

together from 25,000 wood-veneer mini-panels that give the impression of individual pixels. "The virtual crate is a generic object that appeared in several video games throughout my childhood," says McAteer, who's just graduated from Central Saint Martins in London. "I wanted to take this ageless, useless digital relic and transport it into the real world." The sculpture consists of five panels of wood, one for each side, and is



■ Dropping an activist into the digital version leads to chaos spreading



■ "People dying is a necessity. Their 4-bit AI chips can't grasp traffic rules"

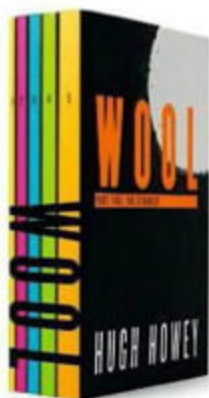
made of a mosaic of five woods: ash, cherry, oak, walnut and wenge. Each panel is constructed from 5,184 mini-units – 2.5cm tesserae that McAteer fixed together with glue. "Lasers are used to cut out each block from a larger piece of material, because the precision has to be extreme," says McAteer, 24. "I built the structure from the inside out and braced the panels with timber." Each of the panels took four days to construct and weighs about 90kg. The piece is currently on display in the Crossing, an exhibition space in King's Cross, London, and at the same venue for the Future Map show in January. As a finishing touch to the virtual-meets-real concept, McAteer left the sculpture unvarnished. "I didn't put on any polish or gloss because I wanted the wood to age and change with time," he says. "Now, this immutable virtual object has gained a lifespan in the real world." **MV** conallmcaateer.com/crate

© EASY AS ABC



To dyslexics, the letters of the English alphabet can seem sadistically similar: b and q – or n, m, and u – are hard to tell apart. Gerald Morin and Kanny Yeung have created a typeface that clears things up. "Its basis was the metaphor that dyslexics view characters as 3D shapes," the pair wrote in a paper for the *Parsons Journal for Information Mapping*. They studied the alphabet, looking at the ears, counters, loops, spines and other details of each letter. Next, they turned each letter into a symmetrical structure, so that the letter is recognisable from all sides (WIRED has coloured them). "At first glance, the unfamiliarity of the typeface overpowers its ability to communicate," Morin and Yeung wrote, but they say they are now working "on making the typeface a bit more accessible aesthetically, based on user testing." TC





FROM DIY WRITING TO HOLLYWOOD ENDING

On Halloween 2011, Hugh Howey stayed up late to watch his self-published novelette sell its 1,000th copy through Amazon's Kindle Direct Publishing system. "I didn't even link to it properly; I didn't think it was commercial," says the Florida-based author. "As a writer, you dream of selling 1,000 copies of anything." Enthused, Howey dropped his plans for other books and started writing a sequel. Five books later, the *Wool* series – set in an apocalyptic subterranean city – has sold 300,000 copies, Ridley Scott has bought the film rights and this month it's being published as a hardback in the UK.

For Howey, his opportunism was as important as the storytelling. "The fact that I jumped on it and rapidly published sequels allowed it to snowball," he says. "At one point, all five of my books were in the science-fiction top-ten. When you have five books with the same title and the same author, it gets a lot of attention." TC hughhowey.com *Wool* is published on January 17



■ The court's façade was reinforced by blasting water, cement and fine sand to form "soilcrete"



■ A double lattice system of steel tubes, varying in thickness between 4mm and 12mm, was added

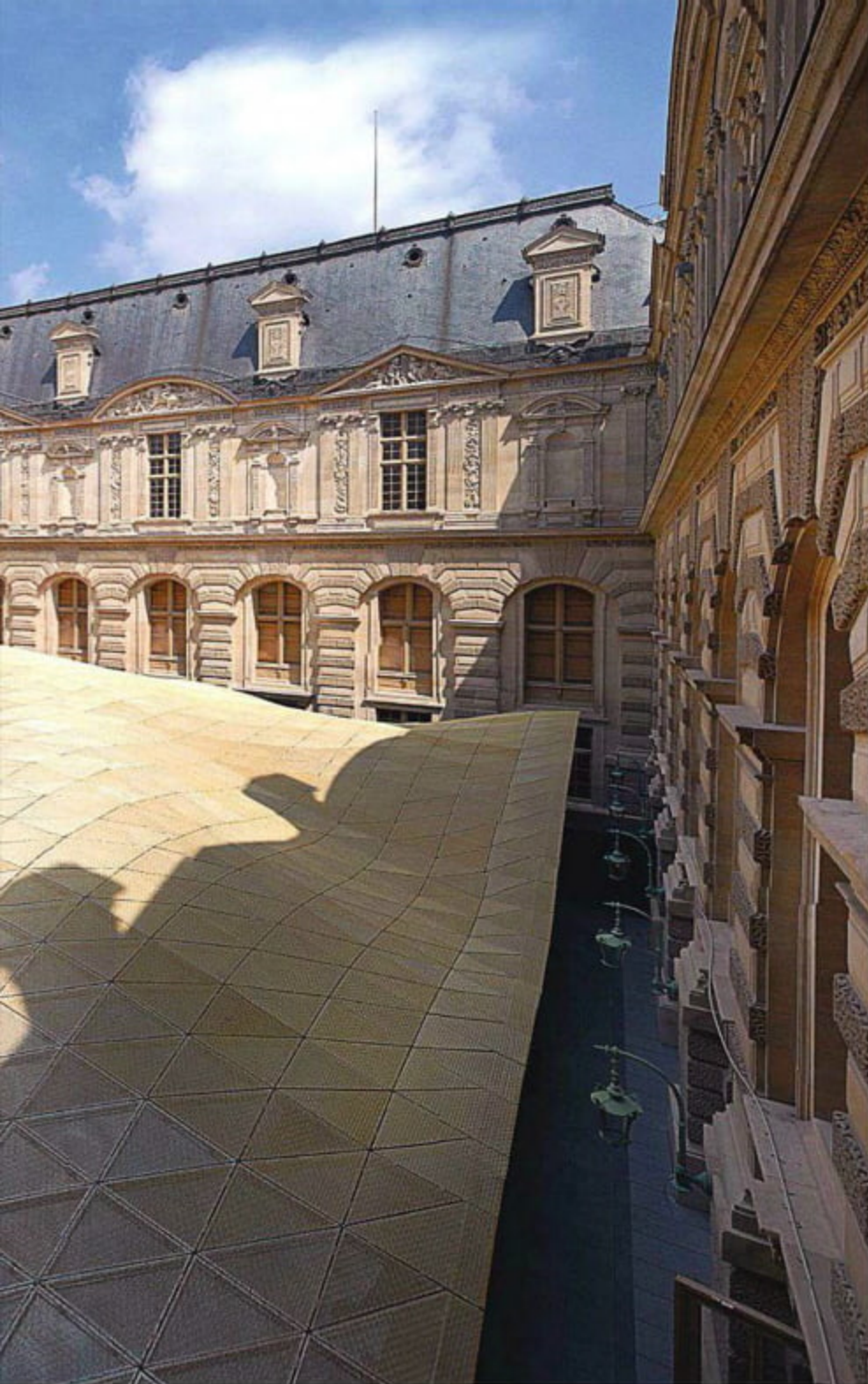
Blanket canvas

Walk underneath the magic carpet to discover the Louvre's newest gallery

It may appear to be a giant sheet floating in the breeze, but the latest addition to the Louvre's Cour Visconti in Paris is grounded by some pretty formidable engineering. Reopened last September after four years in construction, the new Department of Islamic Art is supported by a network of steel tubes, on which sits a glass and aluminium mesh-clad canopy. Eight circular concrete columns, 30cm in diameter and tilted at different angles, bear the entire 120-tonne load.

The geometry and intricate pattern of the gallery's undulating roof required extensive 3D computer modelling to determine the respective positions and angles of inclination for each of the structure's triangles (there are 2,350 in all). "Without [3D modelling] we wouldn't be able to realise the idea," explains Italian architect Mario Bellini, who, along with Frenchman Rudy Ricciotti, designed the gallery.

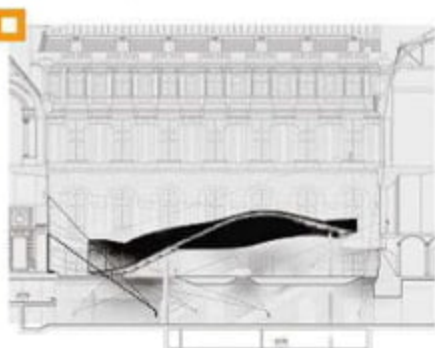
Bellini and Ricciotti submerged the gallery space 12 metres underground, offering extra protection to its more light-sensitive exhibits, many of which are rarely displayed. The resulting interior gallery is darkly subterranean as a result – deliberately so, according to Bellini, who adds that the interior provides "a double contrast between darkness and lightness – under the earth and above within the sky".
Danielle Rago louvre.fr/en



■ The glass and aluminium mesh-clad canopy comprises thousands of triangular pieces



■ The skin's pattern required 3D modelling to determine the triangles' positions and angles



■ The blueprint shows how the roof hovers above the subterranean gallery

#4: INNOVATION

GREAT MINDS THINK AHEAD

SOWING THE SEEDS FOR TOMORROW'S ENERGY

Take a look at energy consumption throughout history and two trends become inescapable: the amount of energy consumed continually increases, and the way it is consumed has become increasingly complex – from burning trees for warmth to highly refined aviation fuel for supersonic flight.

These trends are not about to change. As populations grow, so will energy consumption. Similarly, as resources become scarcer and climate disruption and environmental concerns increase, our energy sources must become ever more varied and ingenious.

That these two trends have persisted is a strong indicator that we've got the tools to meet the challenges of the future. Innovation lies at the heart of our success as a species.

And innovation comes in all shapes and sizes.

In 1892 Shell built the first tanker capable of navigating the Suez Canal. In 1961 it employed the first semi-submersible drilling rig. Today it is pioneering the construction of the world's first offshore floating liquefied natural gas facility (FLNG). On land, in the annual Shell Eco-marathon, hundreds of young student minds compete to design cars capable of travelling the furthest on a single litre of fuel. Just as the challenges of the future won't wait for us to prepare, our innovative spirit isn't waiting to be asked.

Humankind's progress is a testament to our adaptability and ingenuity, but statistics show that typically, it takes 30 years for a new energy technology to reach a single per cent of the market. The answers may be out there, but history has shown that habits change slowly – innovation alone is therefore not enough. The energy industry needs new processes and inventions, but we must integrate them faster than ever. In the words of that other great disrupter, Gandhi: "We need to be the change we wish to see in the world."

To find out more visit: shell.com/letsgo

SUSTAINABILITY AND ACCESS

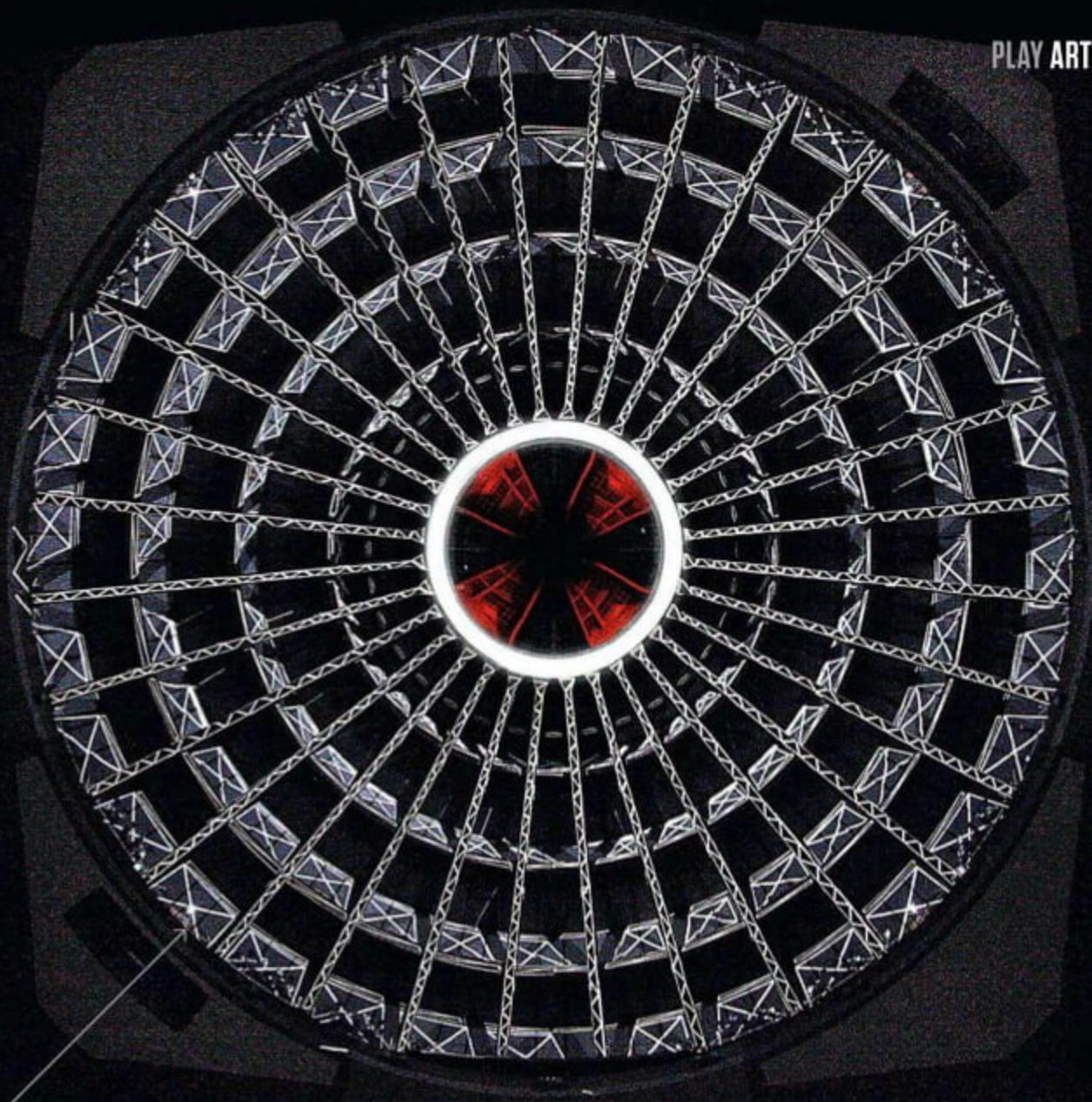
The two immovable pillars in the oil and gas energy challenge are access and sustainability. As for access, the easy stuff is gone. No longer can we simply push a tube into the ground and suck. Today, hydrocarbons are harder to reach and more difficult to extract. This leaves two areas for innovation: reaching previously inaccessible deposits and getting the most out of the fuels we have. Developments in these areas are moving so quickly that scientists are talking of being on the verge of a revolution.

Sustainability is a harder issue to resolve. It's a difficult concept to pin down, but in essence means integrating economic, environmental and social considerations into decisions about the future. It means looking ahead, and the conclusion is inescapable: we must be more efficient. This means better engines and cleaner habits, controlling CO₂ emissions, factoring in environmental impact and, above all, it means education. It means recognising that every action we take impacts the planet's energy burden. If being one of seven billion makes you feel insignificant, just remember: it is that very number that means a tiny change in habits can have huge results.

SHELL AND INNOVATION

With a technical and engineering staff of over 45,000 (including 1,000 PhDs) and close working relationships with industry partners, you'd have thought Shell has the foundation for new ideas well covered. But ideas don't work like that; sometimes it takes a complete outsider with a new perspective to solve a problem. Ideas can come from anyone, anywhere. The trouble is, too often a lack of money, connections or simple guidance snuffs these sparks out in their infancy. Set up in 1996, the Shell GameChanger programme seeks to harbour these ideas and give them every chance of success. To find out more, visit shell.com/letsgo





Omicron art show

An historic Polish concert hall has a new, sci-fi attraction: a dazzling multimedia installation



mapping to blast a dizzying array of visuals on to the dome's surface, turning the concrete arches into robotic arms, the struts into dissolving pixels, and the circular skylight into a HAL-esque all-seeing eye. To accompany the visuals an earthshaking sound track (that was composed within the dome) is blasted from 24 speakers placed around its perimeter.

The 3D projection required the space to be mapped in painstaking detail – Romain Tardy, a codirector, hand-sketched it digitally, via tablet and mouse, over imagery taken of the dome. “We redrew all the details of the architecture of the building,” says producer Nico-

■ The Hala Stulecia is still an active venue for sporting events and concerts

■ AntiVJ recreated the dome digitally for the performance

las Boritch, 36, “Drawing pixel-lines over the dome, one by one.” Once the space was mapped and the visuals designed, four projectors were aligned to create a seamless experience. The futuristic result is a good fit, according to Tardy, 28: “When we first saw this place, we thought it looked very sci-fi. [The dome] is so massive, it’s surreal. It’s almost psychedelic.”

Ben Beaumont-Thomas antivj.com/O



Tablet extra!
Download the WIRED app to watch a video of *O (Omicron)*

Playlist

CULTURAL PICKS
OF THE MONTH 01.13

1 TONY CRAGG

British sculptor Tony Cragg is showing new work in an exhibition at the Lisson Gallery in London. His Early Forms series, which he started in the 80s, mashes up different vessels to create new sculptural forms. Until January 12. lissongallery.com



2 K IS FOR KING

Jim Sutherland of hat-trick design created a chess set using Hoefler & Frere-Jones's recent "Champion" typeface. Check out the inspirations Sutherland documented at graphicchess.tumblr.com. hat-trickdesign.co.uk



3 DIGI-TIES

Digital artist Miguel Chevalier has given the classic Hermès tie a style upgrade with his new 8ties series. His designs feature repeat-pattern USBs, computer keys and power icons – très WIRED. £135 hermes.com/8ties



4 HELEN ARNEY

Helen Arney is a comedian and "geek songstress" who's interviewed Steve Wozniak on stage. She's teaming up with Brian Cox for a gig at the Hammersmith Apollo on December 21. helenarney.com



5 CYCLUS PANGOLIN

This 13-litre backpack for cyclists takes its inspiration from the armadillo-like pangolin. The plates are made from reused rubber inner-tubes and fold back to reveal the pack's many compartments. \$270 cyclus.com.co

BE OPEN

SOUNDS AND THE CITY

THE CREATIVE THINK-TANK
USING DESIGN TO SOLVE
REAL-WORLD PROBLEMS

"The reason I am fascinated in design is that it has the potential to change the world around us for the better," says Elena Baturina, one of Russia's most successful businesswomen and founder of BE OPEN, the creative think tank currently making waves in the UK design scene. Specifically, sound waves.

As part of a programme of activities during London Design Festival 2012, the BE OPEN Sound Portal sheltered at the foot of Nelson's Column in Trafalgar Square. The four-day installation offered visitors a rubberised cocoon in which to escape the hurly burly of inner-city life and witness the soundscapes of five leading sound artists.

An intriguing Sound Design panel at the Hospital Club followed. Here, an eclectic collection of guest speakers – including Tom Dixon, Lauren Stewart, Matthew Herbert, Benjamin Koren and Roland Lamb, moderated by WIRED associate editor Tom Cheshire – sounded out the role audio plays in our existence. As the only sense you can't "switch off", the role of sound is critical in everyday life. Topics ranged from spatial acoustics to the way the human brain seeks out patterns, from data transmission to the materials behind musical instruments.

BE OPEN also created BE OPEN SPACE with Tom Dixon at the Dock in west London, to explore how today's creatives design for the senses. Over the coming year BE OPEN plans to broaden the project and explore all five human senses – sight, smell, taste, touch and sound – as the starting point for research into the next realm: the sixth sense. Throughout 2013, more new projects will be announced, including an exploration into the sense of taste at Milan Design Week in April, before completing the senses circle at the London Design Festival in September.

The future of design is more subtle than you might imagine, and if you don't keep your senses sharp, you may not notice it coming. For more information visit: beopenfuture.com



Above, centre: BE OPEN's founder, Elena Baturina



Above: Lauren Stewart



Above: Tom Dixon



Above: Roland Lamb

BE OPEN: THE MISSION
Founded in 2011, BE OPEN is a cultural and philanthropic project that strives to unite creative minds from across the disciplines. The goal? To build creative solutions for tomorrow's biggest problems.



Above: Tom Cheshire and Matthew Herbert



Above: Benjamin Koren

BUILDING A NEW ERA OF E-COMMERCE

ALLIED WALLET'S CEO ANDY KHAWAJA TAKES ON LONDON - AND THE WORLD - WITH HIS MULTIBILLION-DOLLAR PAYMENT BUSINESS

Andy Khawaja was in retail in the late 90s when he saw how e-commerce was about to seriously shake-up his business. Seeing an opportunity, he dedicated himself to the biggest and most lucrative problem of the day: how to process digital transactions securely - while making the buyer-seller relationship as simple as possible.

"The banks were paranoid about anything to do with credit-cards online. That's where we stepped in," says Khawaja, who founded Allied Wallet, based in California, in 2002 and remains its CEO today. He set about developing a sophisticated infrastructure for encrypting payments, built on revolutionary fraud-prevention safeguards. After years of development, Khawaja was soon reassuring banks with the technology. Ten years on, Allied Wallet is a multi-billion-dollar business and a world leader in payment-processing solutions.

Khawaja lives and breathes his business. "I love what I do," he says. "I'm the CEO who's in my office at four o'clock in the morning, I sleep little and I work seven days a week." Dedicated and eccentric, Khawaja even takes technical customer calls himself when he's on the floor ("Nobody knows they're talking to the CEO," he laughs).

But more than good leadership, Khawaja owes Allied Wallet's success to its global attitude. "We were looking internationally while others were focussed on the backyard," he says. "You can't do that - the internet is global." With such reach, the company weathered local financial storms far better than some: "While a lot of companies lost money, Allied Wallet was tripling its business."

Having faced technological challenges in digitally savvy markets such as Japan, they're ready for when the rest of the world catches up.

Khawaja says he can't wait for what comes next.

To manage European growth, in 2012, the company set up UK headquarters in London. The world's largest financial hub, London offers an unparalleled position from which to provide services to European clients.

Asia too offers untapped potential. Opening the company's doors to India, and finalising a major deal with China UnionPay - enabling Chinese consumers to experience global shopping like never before - Allied Wallet is readying to take on billions of new transactions. "This is a huge deal for us right now," says Khawaja. "I'm going to write a new era for the e-commerce business."

But isn't there risk in over-reaching? "I love to take risks, but I like to take cautious risks," says Khawaja. "I analyse it, I look at the business structure and I make sure we eliminate the risk by understanding." alliedwallet.com

AW TIME-LINE

2002

Andy Khawaja leaves his retail business to found Allied Wallet

2005

Allied Wallet goes public with its Gateway technology for merchants, and digital wallet for consumers

2010

Receives Level 1 PCI Compliance validation - the highest ranking on the industry standard

2012

Inc. recognises Allied Wallet as one of the fastest-growing private companies in America

2012

Opens the company's UK headquarters in Trafalgar Square



INSIDE
ALLIED
WALLET

41M

Forty-one million merchants and consumers use Allied Wallet's services, promising the fastest, easiest way to process payments. The company guarantees that anyone can set up an online store and be open for business in 24 hours.

164

Customers transact in 164 different currencies supported by Allied Wallet, all performed seamlessly and without costly transaction fees. To date, Allied Wallet has processed over a billion dollars in nearly every currency.

0.04%

Allied Wallet's award-winning Gateway infrastructure tracks shoppers' habits and flags up any suspicious transactions. Fraud is steadily decreasing year by year and, in 2011, the fraud rate was less than 0.04 per cent.

0.5Bn+

Until recently, online Visa and MasterCard payments were limited in China. Allied Wallet has just made a deal with China UnionPay (who have a monopoly on yuan payments), giving over 500 million people access to online global shopping.



O N S A L E J A N U A R Y 3

WIRED

N E X T I S S U E

Talent Tube

YouTube's fame
factory creates new
stars every day

IS THIS THE FUTURE OF BROADCASTING?

HOW TO

LIFE ENHANCEMENT

THIS MONTH: 01.13

- BUILD A MUSIC STUDIO
- HACK YOUR EMOTIONS
- GIVE UP CAFFEINE
- PAINT A BATTERY
- FARM A WINDOW BOX
- GATHER LOCAL NEWS
- MAKE A LIGHT-UP WALLET



HOW TO... QUIT FACEBOOK

Want to say no to the social-networking giant, but don't know how to do it? WIRED can help you lose friends and influence fewer people. TC—»



Delete

HOW TO... QUIT FACEBOOK

SAFEGUARD YOUR PHOTOS

Pick&Zip, Photograbber and SocialFolders let you download Facebook photos you've uploaded, and any pictures you've been tagged in. If you want to share or store them in the cloud, Google's Picasa is the easiest way to move them - its Move Your Photos extension for Chrome proves useful here.

DOWNLOAD YOUR DATA

For your Facebook data, go to "account settings" and click "download". Send other data such as contact info to your phone with Address Book for Android and SmartSync for iOS. To save birthdays, go to "events", click "settings" and select "export" to push them to an Outlook, Google or Apple account.

DELETE YOUR FACEBOOK PROFILE

Rather than trying to navigate through Facebook, the easiest way is to type "facebook.com/help/delete_account" into your browser, and follow the steps. At the time of writing, Facebook Ireland faced an £80,000 fine for retaining users' deleted data, so don't expect your details to be scrubbed right away.

STAY STRONG AND STAY OFFLINE

For your Facebook account to disappear permanently, you must not log in for 14 days after deleting it. That includes not logging in via your smartphone or any web apps that are linked to your Facebook account. Log out of these apps - or safer still, delete them entirely until your period of quarantine is up.



HOW TO...

BUILD A MUSIC STUDIO AT HOME

If you want to make your own music, a home studio has never been easier to build. Anth Gaskill, co-author of production book *Complete Music Producer: Essential Skills to Become a Success*, gives some sound advice for budding super-producers. **Ben Beaumont-Thomas**

1 POSITION YOUR SPEAKERS FOR FULL EFFECT

Place your speakers at least a metre away from the wall. "Higher frequencies tend to feel focused and directional, whereas low frequencies have a more 360-degree spread," says Gaskill. "If your speakers are close to the wall, bass frequencies will reverberate and you end up with a wave being reinforced and amplified." Angle and distance the speakers so that they form an equilateral triangle with the listener's head.

2 CONSIDER THE ABSORPTION AND DIFFUSION OF SOUND

"You don't want concentration points of sound reflections, so you need to make the environment break the sound up evenly," explains Gaskill. Avoid smooth, flat surfaces. You don't need the full egg-box treatment, just place shelves and pictures randomly along the walls to disrupt sound reflections, and lay carpet on the floor. Modern houses have insulation in the walls, but if not, hang thick material to stop sound leaking.

3 DON'T RELY ON YOUR HEADPHONES AS A GUIDE

They'll preserve your neighbours' sanity but they won't accurately reflect how audio will sound through speakers. "Stuff that's panned really wide will feel concentrated in headphones, but when you listen through speakers it can sound disjointed," says Gaskill. Note the volume it will ultimately be played back at before turning down the volume to work on the piece. This will prevent loudness from obscuring any unsophisticated work.

4 KNOW WHEN TO MOVE TO A BIGGER SETUP

Although able to do a lot in a small space, guest musicians might find it hard to get inspired in your box room. "A common trick is using an old mattress to create a space around the singer; the mattress has really good sound absorption so you can get quite a dry vocal," suggests Gaskill. "But if you've got someone coming in who you don't know, it's not the best aesthetic and it might impact upon their performance."

BREAK YOUR CYCLE

"We have this achievement-oriented society and culture, and anything that interrupts that cycle is helpful," says Alicia Morga, creator of *gottaFeeling* and a Silicon Valley entrepreneur. "When you get that ping on your iPhone, it's a moment of mindfulness. Users have said they've been able to go back and see how they were in a bad mood a moment before, and that it got better. So sometimes just putting your emotions in context is really valuable."

QUANTIFY YOUR ENVIRONMENT

The *mappiness* app asks you to share how you feel and blends the results with GPS location, weather data, noise levels and more. "Say people spend £10 on a cinema ticket, which gives two hours of happiness," says the app's co-creator, George MacKerron. "If they get twice that happiness up a mountain, you can say the mountain was worth at least £20 to them. Or take a plan to sell off forests – the app might tell you the value of those forests remaining accessible."

EMBRACE ALL EMOTIONS

"Between a user signing up and completing about 500 responses, there is an average five per cent rise in happiness," says MacKerron. But whereas the pursuit of happiness is not necessarily flawed, don't mindlessly pursue it, says Morga. "Emotions are just emotions – neither good nor bad. If you can identify and manage what you're feeling, you can express it more cleanly."

HOW TO...

HACK YOUR EMOTIONS

A

re you so buttoned-up that you regard tears as "confusing eye-water"? Maybe it's time you dug into your emotions. Apps such as *mappiness* and *gottaFeeling* encourage you to share your feelings at random throughout the day. Here's their guide to paddling in Lake Me. BB-T



ILLUSTRATION: ALEX WALKER; MARK LAZENBY; SCOTT GARRETT

HOW TO... FARM A WINDOW BOX

Tom Moggach, who wrote *The Urban Kitchen Gardener*, shows how to grow a patch. Mark Russell



THINK BIG – THEN DOUBLE IT

Place your box on a sunny aspect. "Get the biggest box you can," says Moggach. "You can get a bracket which slots over, allowing for a second box one tier below. If it is three metres from a road it's safe [from pollutants]."

CHOOSE YOUR FILLING

"Use a soil-based compost," says Moggach. "It dries out less quickly than multipurpose." Then divide your boxes. "Slot individual pots into the container. You might have space for four or five pots, which you can move if a plant is finished."

PLANT HARDY GROWERS

Choose crops wisely, advises Moggach. "You want plants that will last a long time and give structure. Hardy perennial herbs such as rosemary and thyme are good in the middle because they give a lot of harvest and will be there all year round."

GET THE MOST FROM YOUR PLOT

Urban gardening isn't just about herbs. "With decent sunlight a ledge can grow chillies and tomatoes; with 20cm of soil you can grow carrots," Moggach recommends bull's blood beetroot, and, as a winter crop, rainbow chard.

REGULARLY CHECK ON PROGRESS

Unlike a real farmer, you won't have to tend your crops at the crack of dawn. "Every morning when you have your first cup of tea, take a glimpse," says Moggach. "If you dig your finger in and can feel water, then they don't need any more."

HOW TO... GIVE UP CAFFEINE

A constant flow of tea or coffee can seem as integral to a business as seed capital, but caffeine can strain the heart and disrupt hormone levels – not forgetting the coffee breath. Marc Alabanza, programme director at The Ranch health farm in Malibu, explains how to kick the habit. BB-T

KNOW THE EFFECTS

"You rely on an external force to do what the body would normally do for itself," says Alabanza. "The body compensates and says, 'OK, I don't have to do any of the things that make sure the body and brain are at top working level. The chemicals will do it for me.'"

MONITOR YOUR BODY

"Identify how much you take in. Gradually eliminate it for a week, or longer, and see how your body does," Alabanza suggests. It takes 24 to 48 hours for caffeine to fully metabolise and leave the system, so if it's a daily habit, you're never letting it dissipate.

REPLACE THE RITUAL

"We're ritualistic," says Alabanza. "Part of my addiction to coffee was the morning ritual of grinding my beans and reading the paper." Find a new ritual that won't harm your health, and get the same energy jolt and blood flow by doing press-ups or walking up and down the stairs.

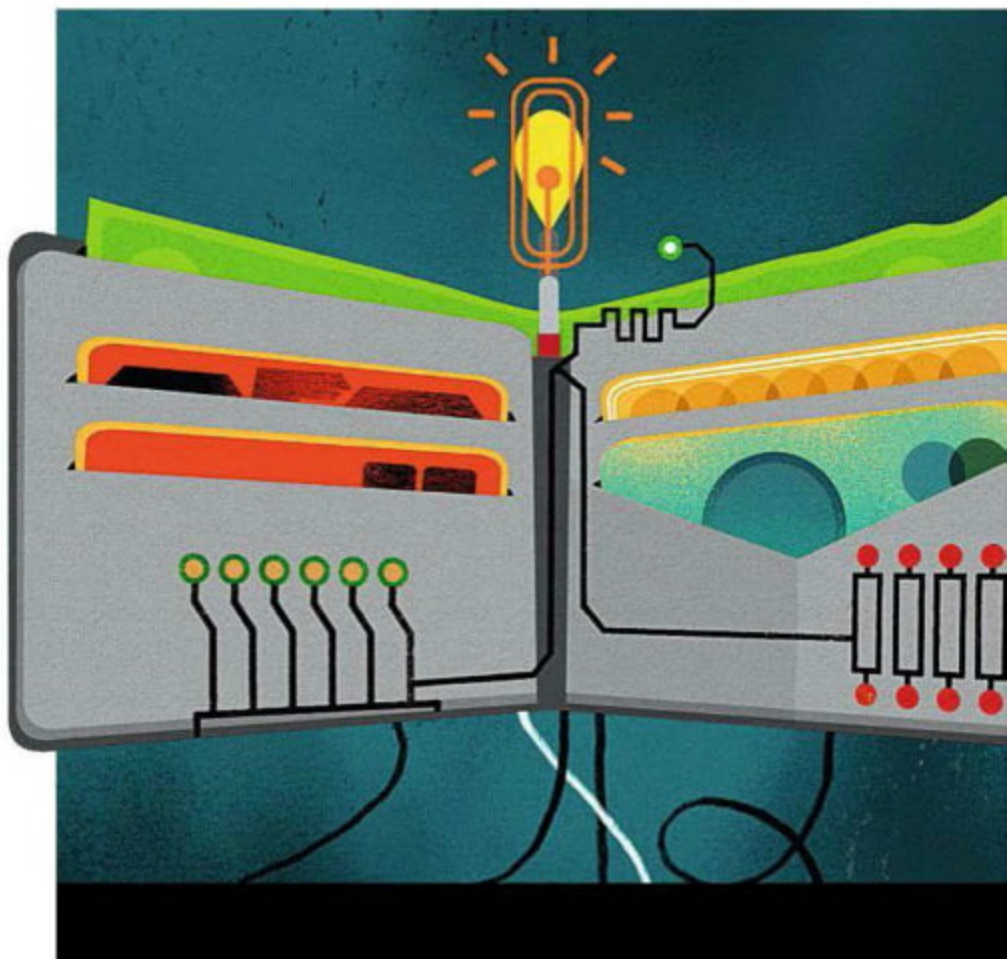


HOW TO...

MAKE A WALLET THAT LIGHTS UP

M

aking wallets out of dead cows? Hardly very WIRED. Ken Denmead, author of *Geek Dad* (Viking, £12.99), explains how to make a wallet that glows, using duct tape, a fiver and some simple circuitry. Oh, but don't stow the finished product in your back pocket when everyone has finished admiring it – the bulb is easily crushed.



HOW TO... PAINT BATTERIES

Researchers at Rice University, Houston, have created a battery made of paint. "We've airbrushed it on to tiles, polymers, glass and steel," says grad student Neelam Singh. Here's how to harness the power of art. Madhumita Venkataraman

ASSEMBLE YOUR PAINTBOX

Your paintable lithium-ion battery comprises five coats of paint, each representing a component of the battery: the lithium-titanium anode, two current-collectors made of a solvent, a cobalt cathode, and a polymer separator that holds the electrolyte.

LAYER THE COMPONENTS

The paints have to be applied in a certain order: the separator is in the centre, between the anode and cathode, and the two current collectors seal the sandwich. "You have to wait for each layer to dry before applying a new coat, like painting a wall," says Singh.

ILLUSTRATION: JUSTIN GABRIEL; LAURIE ROLLITT;
MATTHEW BILLINGTON; SCOTT GARRETT

1. GET AN OUTLINE

Lay three overlapping rows of tape to create a rectangle 17cm x 12cm. Using a £5 note as a guide, trim the tape 2cm wider on each side, 1cm below and 4cm above. Turn the sheet over and lay it sticky side up. Cover with new pieces of tape and trim to make it 1cm wider all the way round. Cut the corners at 45 degrees. Flip it, then fold and stick down the overlapping edges to produce a sheet of double-backed tape the size of an AAA battery holder.

4. ASSEMBLE IT

Turn the sheet with the pouch face down. Line up a lower corner and side edge with your new sheet. Make sure the open end of the pouch faces up towards the new sheet's finished edge. Fold the sticky tab of the new sheet over the edge of the old one. Align the bottom of the first sheet with the inside edge of the new sheet. Fold the bottom tab up and over. Align the other sides and fold over the last sticky tab, to attach the two sheets with the pouch inside.

2. PREPARE THE POUCH

Repeat as for the larger wallet, but make a sheet 5cm x 7.5cm. Don't cut the corners or seal the sides. Trim the corners at 90 degrees and seal the top side by folding the flap over. On the bottom flap, trim so that it has three serrated-looking tabs. These will be the bottom closure. Using the battery holder, roll the pouch so that the left-side tab seals into a tube. Leave the right tab free to attach the pouch to the wallet.

5. WIRE IT UP

You can make the circuitry as complex or as simple as you like. Here is how to add a battery/bulb/switch combo: take the battery holder, without batteries, and attach one lead of the mercury switch to the negative end. Wrap the wire in such a way as to keep it from shorting. Cut small strips of tape to hold the switch to the side of the battery holder. Place the mercury switch so that when the wallet is open, the switch is activated.

3. SEAL THE EDGES

Fold the bottom-serrated tabs in to create the pouch's bottom. Attach the hanging tab to the left of the sheet. The pouch should be 1cm from the bottom of the sheet. Fold the sticky tab over and behind the sheet's left edge. The inner sheet should be 9cm to fit the pouch, so cut 18cm wide. Apply the second face of tape, and flip the sheet. Trim the top corners at 90 degrees and bottom ones at 45 degrees. Fold the top flap down to seal it.

6. CONNECT THE BULB

Attach the other lead of the switch to a short length of wire, so the circuit can reach the positive end of the battery holder. Connect one lead of the lamp to the wire and the other to the positive lead of the battery holder. Tape it to hold it together. Insert the battery and test the switch. Slip the holder inside the pouch. The bulb should just stick out of the top of the pouch, but should not clear the wallet. Put a few notes into the billfold and marvel.

SEAL THEM UP TIGHTLY

To seal the battery, you can use the aluminium foil found in coffee-sachet packaging. "Cover your battery with the plastic-encased foil, and use a hot sealing-iron to seal it." Ensure the packing is at least two centimetres larger than the battery area.

POWER THE RESULTS

The battery now needs to be charged up with a 120-volt power supply. You can use a standard electronic device charger as long as you make physical contact with the electrodes. The separator layer acts as a preventive against short circuits.



HOW TO... CREATE A HYPER-LOCAL NEWS RESOURCE

What's more local than local news? Emma Meese and Andy Williams, from the Centre for Community Journalism at Cardiff University, explain how to set up your own hyper-local site. Mark Piesing

DO YOUR RESEARCH AND KEEP IT LOCAL

Talk to people online in community forums. Find out who your audience is and what they want. Stand on your high street with a survey. "Go back to basics," says Williams. "Tell people what's going on in their area": council meetings, break-ins, public events.

A LITTLE TECH WILL GO A LONG WAY

"Don't get hung up on technology," says Meese. Customise free platforms such as WordPress or Tumblr. "Some people have been able to expand into a free print model which can open up bigger revenue streams," adds Williams. Try newspaperclub.com for production help.

QUALITY CONTENT TRUMPS CLEVER DESIGN

"It's better to have great content than a snazzy site," says Meese. At its best, local news provides a forum for debate and a platform for citizen reporters. "The future of local news lies in more meaningful collaborations with the public, not fewer," explains Williams.

NETWORK, NETWORK, NETWORK

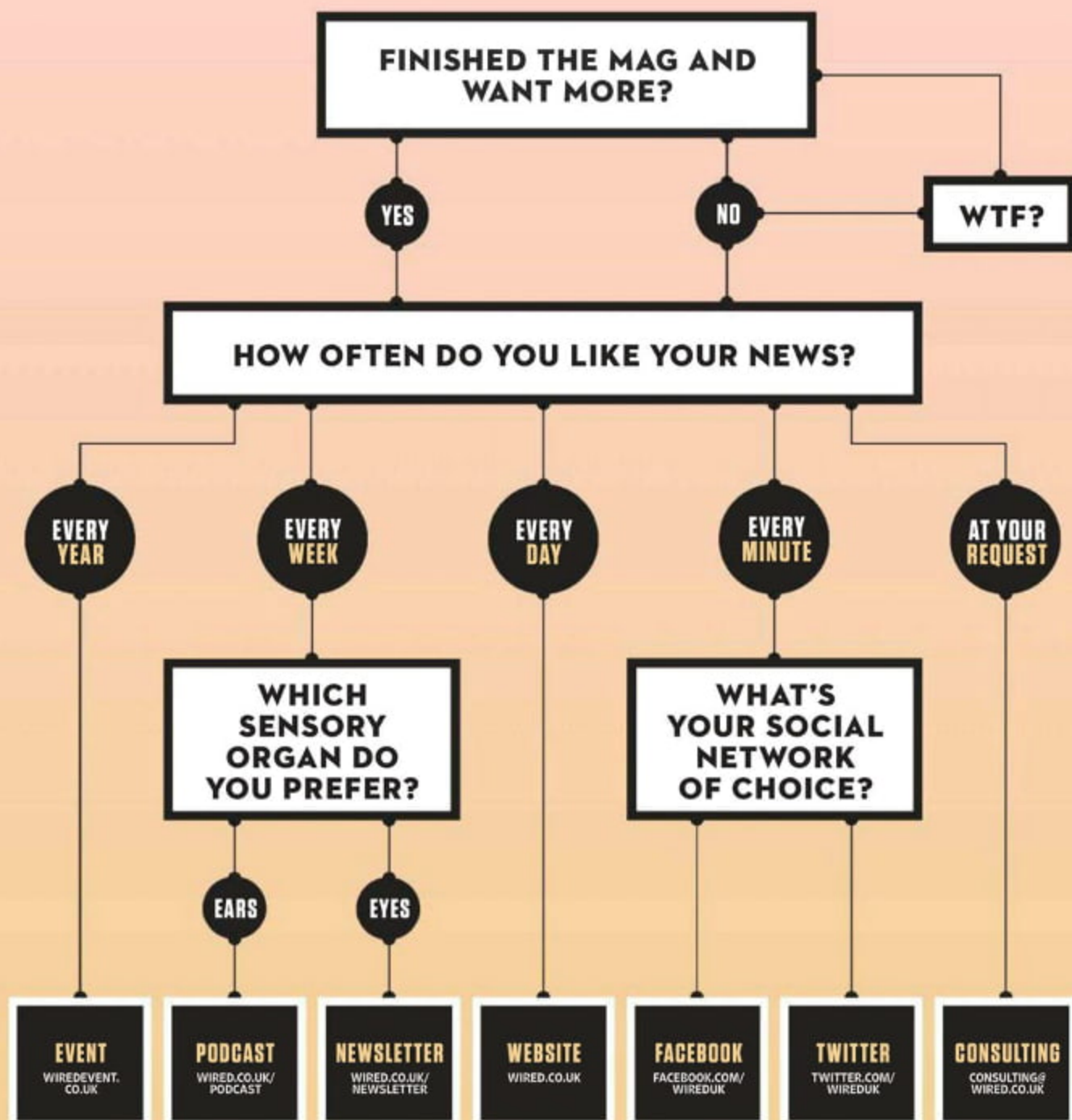
Find other hyper-locals that share your vision, says Williams, and start building your own network. Plugging in to local, national and international news-producer networks is "a great way of picking up tips as you learn". There's a good directory at gohyperlocal.com.

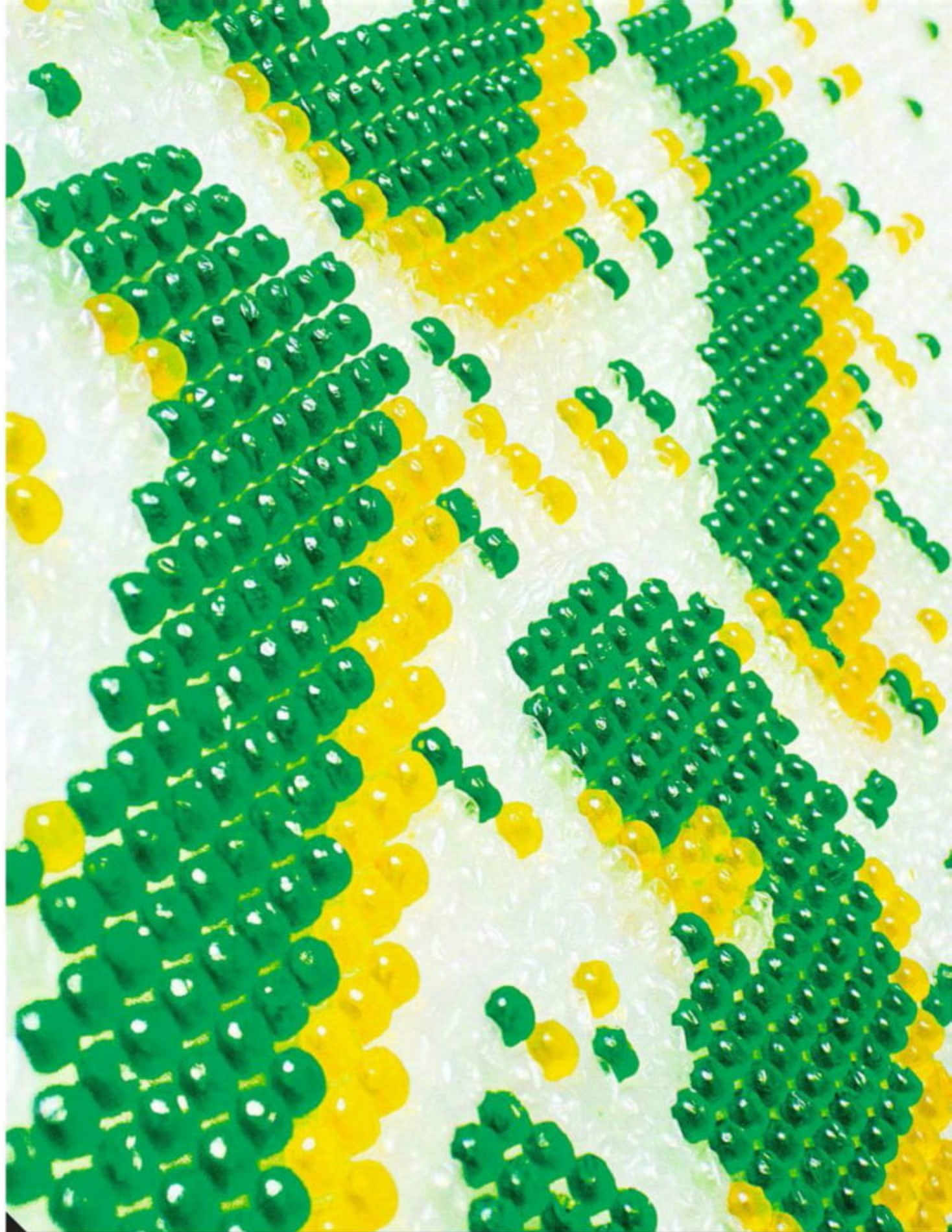
CHECK YOUR FACTS AND FOLLOW YOUR VALUES

Hyper-local journalists have to follow the same laws as any other journalist: if you publish something, it has to stand up. "Any information that is libellous, in contempt of court, in breach of copyright or is factually incorrect may land you in court," warns Meese.

WIRED

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FEATURES/01.13



GOOGLE IS
MOVING ON FROM
SIMPLE DATA-
RETRIEVAL TO A
SYSTEM THAT
UNDERSTANDS HOW
WE THINK AND
WHAT WE WANT -
BEFORE WE EVEN
KNOW WE WANT IT

BY
TOM VANDEBILT



THE
FUTURE
OF
SEARCH



MEETING

Amit Singhal,

Search

a senior vice president and fellow at Google, and the man who orchestrates the battery of algorithms behind your queries, it's hard to resist complaining about search results. Imagine you were driving in northern Massachusetts looking for a restaurant that you vaguely remember had "Sugar Shack" in the title. Typing "sugar shack," however, yielded, as the number one entry, a business billed as "Wisconsin's Premier Adult Entertainment Club". Given that you were a thousand miles away, and had your wife and children in the car, let's just assume a lap dance in the US's dairyland was not exactly top of mind.

And yet it clearly was for Google. Granted, the search was abstract: another word or two – what engineers call "refinements" – and it would have found the right place. Given that many of us can remember a time when finding such information would have required knowing an address and wrestling with a billowing paper map, it seems almost rude to ask Singhal, who is sitting in a conference room in Mountain View: "Why didn't Google understand me?"

He clucks a bit and replies, in a patient tone: "Search is by no means a solved problem." Singhal quickly gets diagnostic. "You were in Massachusetts. Near Hadley. Sugar Shack should have meant something else. I don't know what phone you were using but looking at that one," he glances at the iPhone on the table, "sometimes we don't get the location." Without context, we are stuck in what futurist Paul Saffo calls the "Boolean prison of search". (George Boole, a Victorian mathematician who pioneered the binary approach, is regarded as one of the fathers of computer science.) Encased by a particular word combination and what it statistically seems to represent – for instance, sex and baked-goods emporia – we are dragged down the paths of everyone else's preferences.

What is remarkable here is not that a search like this didn't quite work the first time, but the expectation that it should have. In just a few years we have gone from search engines – the name now sounds as archaic as the Victorian "difference engines" – with their roots in the staid academic discipline of information retrieval, to, simply, "search", which is much more than an apparatus and something closer to a digital prosthesis. As John Battelle, author of *The Search*, says, "Search is now more than a web destination and a few words plugged into a box. Search is a mode, a method of interaction with the physical and virtual worlds. What is Siri but search? What are apps such as *Yelp* or *Foursquare* but structured search machines? Search has become embedded into everything, and has reached well beyond its web-based roots."

Search has become strangely intimate, a trusted friend pointing you in the right direction, or occasionally giving you an unsettling glimpse into the world. Search, Battelle suggests, went from looking for what we knew on the web to looking for what we don't know. Now, he says, even when we don't know what we don't know

– that Rumsfeldian state of "unknown unknowns" – we head to Google, tentatively entering a few letters, waiting for the instant feedback of autocomplete (we no longer have to remember, as one Google engineer put it, we simply have to recognise), wondering what precise phrasing will yield the right data. We then stumble upon the footprints – the digital "slime trail," as the investor and entrepreneur Esther Dyson describes it –



[amit singhal.jpg](#)

[google.co.uk](#)

2000 x 1333 – (Previous spread) Central cooling plant in Douglas County, Georgia.

2964 x 2400 – (This page) Singhal with Scott Huffman, engineering director

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of where people have gone before. You hear a song with the lyrics "How do I know if he really loves me?" and you begin to type in order to discover the artist. But before you finish typing you're being pointed, via autocomplete, down darker corridors, simultaneously personal and aggregate: how do I know if I have bed bugs? How do I know if I have a yeast infection? We once used search engines to look for information, now we use search to find *us* - what once seemed transactional now seems an extension of ourselves. Consider the exercise of finding the current time in Australia. This would once have entailed the following steps: 1. Knowing the current time where you are; 2. Searching for a reputable application that translated time zones; 3. Entering your location and choosing Australia from a separate menu. Now, on Google, you simply type - or ask, via voice - "What's the current time in Australia?" Google does the work and understands what you want. *Understands*. "As a scientist I can say 'understand' is a poorly understood concept," says Singhal. "Even how you and I understand something is not well understood."

No one knows better than Singhal how much Google does not understand you. "How big?" is a very ambiguous question," he says. "Are you looking for length or width? If you say, 'show me the money', you are talking about something else than if you say, 'show me a picture of a dahlia.'" Or take a simple word such as 'kings'. "In yesterday's world, you typed this five-letter sequence, we find the best pages," he says. "We may find the Sacramento Kings [basketball team], we find the TV series *Kings* - we don't understand any of this." Google is like the Thai

THE 'KNOWLEDGE
GRAPH'
CONTAINS MORE
THAN
500
MILLION
ENTITIES

champion *Scrabble*-players who memorise the entire list of acceptable words - without actually knowing what they mean.

However, in the search of the future that Singhal and his masters of disambiguation are constructing in Mountain View, Google will understand that these things are not simply matching sequences but that they are "things" with an internet life and place and history of their own. Based on who you are it will know which one of these, or any other "kings", that you are seeking. And it will do so via increasingly sophisticated

methods: "be it understanding your speech, your gestures, or what you are looking at," says Singhal.

Singhal, a former student of Gerard Salton, the Harvard and Cornell University computer scientist who pioneered digital search, is old enough to remember when a cutting-edge, hypertext information retrieval system, such as InDecks or McBee, involved edge-notched cards and sorting rods. But his dream goes back further, to being a boy in India watching a black-and-white television. "We didn't produce enough content in India," he says, "so all I watched were *Star Trek* reruns." That's where his dream was born. "You walk up to the computer and say, 'What's the atmosphere on that planet down there?' That's what I want to build."

people have been trying to organise the world's information for a long time," says John Giannandrea, a bearded and garrulous Scot, over lunch at the Google campus (he picks the seat at a table in the midday sun: "I'm from Scotland, I never get tired of California"). "I'm fond of the story that Alexander the Great had the best teacher possible, Aristotle. And Aristotle knew roughly everything there was to know."

Today, the quest for knowledge is less important than simply managing it. "We're in a world where almost everything is at your fingertips," says Giannandrea. "But how do you go through it all?" Enter the Knowledge Graph. Envisioned as a database of all the world's useful information upon its creation in 2005 - under the startup Metaweb, in which Giannandrea was joined by programmers Danny Hillis and Robert Cook - in 2010 it was acquired by Google and received, as he puts it, "a massive turbo boost". "One of the things we're trying to do is first to catalogue everything in the world you might want to know about," he says. "We're also trying to marry that with the knowledge that the search engine already has about what people are actually looking for."

Take, for example, New York City Mayor Michael Bloomberg. He exists as an "entity", one of the more than 500 million things in the Knowledge Graph. (Wikipedia, Giannandrea notes, has "about four million things it knows about in English.") Bloomberg's daughters, Georgina and Emma are entities, as is his university, Harvard Business School. In the vast semantic graph that the Knowledge Graph represents, the connections, or "edges", between Bloomberg and his daughters, and where he was educated, are also "things".

And so when the user searches for "Michael Bloomberg", Google is not looking for the web pages that contain that string of letters, but for the entity known as Michael Bloomberg. "With the Knowledge Graph," says Singhal, "Google has become smarter. Search now understands that the Taj Mahal is a building, but also a music band, a casino and a bunch of restaurants." Things, not strings, as Google likes to say. For Michael Bloomberg, the way the Knowledge Graph

[google infrastructure.jpg](http://google.infrastructure.jpg)

google.co.uk

3000 x 2000 - Water-vapour plumes from the data centre at The Dalles, Oregon

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"surfaces" this information is, to the right of its traditional blue links, a panel of curated data, including biographical details and, thanks to past queries about him, his net worth. Type in "Tom Cruise", and you'll see, prominently displayed, his height. Type in "Amit Singhal", and you'll see that he was born in Jhansi, as well as a link to his mentor, Salton.

The larger goal of the Knowledge Graph is to enable computers to understand the world the way humans do. "Our computers don't have any notion of these things that we take for granted," says Giannandrea. "We know there's a book called *Infinite Jest*, written by an author, David Foster Wallace. When I say *Infinite Jest* you say, 'Oh, he means that book'. Our computers, until now, didn't have anything other than data and text. They didn't put any meaning on text so they couldn't understand what they had." *Infinite Jest* could have been anything; now Google understands *Infinite Jest* as a thing, and all its forms: hardcover, paperback, Kindle.

But what's an entity and what's an edge? If David Foster Wallace, a thing, went to Estonia, a thing, is there a new thing based on the metadata between Wallace and Estonia? "It's slippery," Giannandrea says. "What's the definition of an entity? I'll know it when I see it. It doesn't have to have a name. It could be an event - an artist playing at a venue at a particular date. Is a specific plane trip an event? Yeah, probably, so every day there's another 30,000 events. Are

GOOGLE
LAUNCHED ITS
'BABY' INTO A
CORE SAMPLE OF



MILLION
STILL IMAGES

all the unnamed stars in the universe entities? Probably not." The Metaweb and now the Knowledge Graph, has been absorbing the world's structured databases. "St Andrews [University] has detailed information about the careers of mathematicians; the same for philosophers at Stanford," says Giannandrea. "At Berkeley there's an expert in bees. He's got this database of 40,000 species. There are websites that catalogue roller-coaster rides, with specs about G-force and how many curves and when it was built. There are these incredible pockets of information about almost any vertical you can imagine." The work of the semantic graph is to make the connections that traditional search might overlook. "You'd be surprised at how many times there's a serendipitous link between two different things," he says. "It can be hard to describe for computers to understand that: what's the relationship between Einstein and Gandhi? They were both pacifists in later life." This might be a common search inquiry, he suggests,

but the computer cannot work out why.

As much as trying to know everything, the Knowledge Graph is about trying to work out what you want to know, parsing the disambiguation ("did you mean?") and filtering noise. Search is bedevilled by things like hypernyms: words that mean the same thing as a more specific usage. Take the word, "jaguar", for instance. "It has, like, 26 different meanings," says Giannandrea. "The animal; the Mac

HOW GOOGLE SEARCH WORKS



1. SPIDER DISPATCH

Like many search engines, Google uses "spiders", robot programs that scan new and updated pages and index every word (except "a", "an" and "the"). Called Googlebots, they follow links from page to page, making its index more comprehensive.



2. INDEXING

The index doesn't contain just keywords, but also metadata: information on whether the keywords were capitalised, their font size, and where on the page they were found (in the title, subtitle or lower down), in order to help rank the importance of the page.



3. RANKING

The unique feature of Google's search algorithm is PageRank. It rates a page's importance based on the number and reputation of links that pointed to them. It also considers things like how often keywords appear, the freshness of a page and which sites link to it.



4. DEFINITION

The algorithm uses over 200 signals to refine a search query. These include a website's PageRank, a searcher's geographic location, which links they usually click, how they modify their search queries when they are unsatisfied and their search history.

operating system; there's a popular artist in South America." By recognising them as humans do and not just as groups of letters, the Knowledge Graph, he says, can help "change our understanding of user intent."

Google doesn't just let algorithms do this work. The Knowledge Graph was beta tested by any number of people in its User Experience Lab. "We ran 12 tests on Knowledge Graph," says John Boyd, the manager of the lab, which is equipped with two-way mirrors and eye-tracking devices. Early studies looked at whether users, habituated to Google's layout, even saw the Knowledge Graph. Often they didn't, just as they often didn't see "Google Instant" results ("I'd characterise queries as a sort of quantum phenomena," Boyd says. "Often they're going to type it out, no matter what they do.")

With the Knowledge Graph, Google has taken a different step towards

the future of search: providing answers, not links. This raises the question of authority, long on the mind of Google engineers. A few years ago, Google faced controversy when it was revealed a search for the word "Jew" returned several anti-Semitic websites. Through brute algorithmic logic, it made sense: the sort of people who use the word "Jew" tend to have those sorts of proclivities. Now a search for that word leads in short order to an explanatory page from Google (which states, in part: "Someone searching for information on Jewish people would be more likely to enter terms like 'Judaism', 'Jewish people' or 'Jews' than the single word 'Jew'. In fact, prior to this incident, the word 'Jew' only appeared about once in every ten million search queries"). While Singhal says that "time and again we decided that Google shouldn't intervene in the [search] process," it is constantly shaping the world – for example, it recently struck the peer-sharing site The Pirate Bay from autocomplete – and the fact that "Holocaust denial" yields very different results than "Holocaust lie" is as much a social as a search issue.

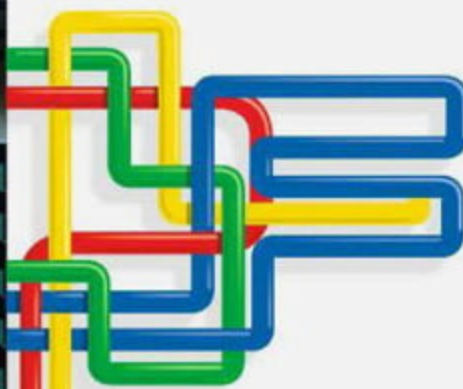
The Knowledge Graph also challenges the organisational hegemony of Google's dozen blue links. "The web is very top down, in terms of links and anchors," says Giannandrea. "What you can't really do in a web browser is look at a page about a particular play and think, 'What other plays should I consider?' We need to be able to go sideways through human knowledge." This is figurative, but also literal: entering "London bridges" on Google, one now sees an image carousel of London's most significant bridges, arrayed horizontally. This is possible because those bridges have been encoded as entities in the Knowledge Graph. But what happens when that knowledge is not encapsulated in structured databases, when it's not a piece of text, or even when the subject of one's search is something the user is looking at in the moment?

google_infrastructure.jpg

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2000 x 3000 – Backup-tape libraries in Berkeley County, South Carolina

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finding cat videos on YouTube is easy: go to YouTube and type in "cats". The reason you find them is because they have been tagged with the word "cats." What if you wanted to find every appearance of a cat, however fleeting, in all of YouTube's videos?

This was not what Jeff Dean, a fellow in Google's Systems Infrastructure Group, and his colleagues had in mind when they set out to create a neural network for "unsupervised learning", meaning recognising images, such as faces, when they weren't tagged or demarcated by boundaries, as

in some recognition software trials. The algorithm consists of a vast number of "neurons" – a billion "trainable parameters", which dwarfs other systems but is still a fraction of the human visual cortex – across an army of computers. "Each neuron looks at a fairly small patch [of a sample image]," says Dean. "It's taken inputs from the raw pixels and computed some function, and this neuron over here is doing something similar. You can have different neurons with different weights that look for different features." These neurons comprise a "layer". At low levels, they're just trying to recognise the barest outlines of an image. "As you move up, the features get higher and higher."

Dean, who speaks in an intense staccato, pauses. "It's sort of like what happens with a newborn baby." They get a lot of optical stimuli; they start to look at patterns. "One of the most common things you see as a newborn is faces. Pretty quickly they start to form associations that this is an important thing that I'm seeing a lot." Google launched its "baby" into a sample of 10,000,000 still images from random YouTube videos. It turned out that one of the neurons was highly selective to whether there was a face present, "even though we never told it any of the training data had a face in it." He shows some images on his laptop – spectral faces with hollowed out eyes. "These images caused it to fire the most. It's picking up on the eyes, mouth and nose, and the circular nature of the face." With each pass the network gets better at recognising what it sees.

The other things the neurons were good at recognising were, it turns out, cats; because there are lots of images of cats on YouTube. The neural logic is: cats occur in a lot of images, so the network wants to optimise itself to recognise this thing that seems important. This is, in essence, search. What Dean calls "unsupervised learning" could be termed unsupervised search – machines that not only find, but interpret what they find, a search engine that generates its own algorithms. And Dean envisions the networks will be useful for words as well. Words will be represented by high-dimensional vectors: a word such as "dolphin" will be put in a 100-dimensional space ("I'm only drawing a

3D space because I'm not good at drawing 100 dimensions," he jokes). "Over time, you're going to push words that you find to be closely related, closer together. And you push other words farther apart." You need that many dimensions, he explains, "Where you can push some of the words in some of the dimensions without destroying their association, their proximity to other words in other dimensions." How closely these words lie near others will help determine context and relevance.

This sounds like the semantic web described by Tim Berners-Lee as a "web of data that can be processed directly and indirectly by machines." As Greg Linden, who invented Amazon's recommendation engines and founded Findory notes, says, "I don't think we'll ever get to the semantic web as it was envisioned – detailed labelling and descriptions of web pages by humans – but we are getting closer to its goal: deep descriptions and understanding of the web, through artificial intelligence and natural language understanding." Google, he suggests, has decided that labelling web pages is beyond humans, and is turning to machines. These are the pillars of Google's future of search:

the vast knowledge of user behaviour and intent it already has and is compiling every second; the Knowledge Graph, in which strings become things; and Google's advances in artificial intelligence.

But the promise of that future should not disguise how hard search still is. When Google acquired Metaweb in 2010, a company statement noted that the deal would help it carry out more complex searches. The example it gave was "colleges on the West Coast with tuition under \$30,000." Today, that search coughs up articles about the Metaweb acquisition. "Problems still plague search," says Linden. "The typical query is short and ambiguous – such as [looking for] pizza. Dealing with that requires understanding of the underlying need."

"A link is not at all an answer," says Oren Etzioni, professor of computer science at the University of Washington and founder of Decide, a search engine that analyses optimal purchase options and timing. "We've been conditioned by years of using Google to think it is." A pizza inquiry, he suggests, "is treated by a search engine as information retrieval. You wanted something that performed a deeper analysis, computed your location. You don't just want the nearest ones – what are the nearest high-quality, well-reviewed places? That's actually a huge problem, they don't analyse the reviews." Etzioni, with some students, is working on revminer.com, a program that extracts data from Yelp reviews.

Singhal believes that search is best done on a mobile device. "We are building our technology where it's needed most," he says: Android 4.1. With mobile search set to exceed desktop in 2015, according to research firm IDC, we will need what Singhal

3 FURTHER SEARCHES

BING

Strengths: Related searches appear in the right-hand column, and it has a very refined image search. With the integration of Farecast, it can give the best fares. **Weaknesses:** It can't fill gaps if you get the search term partly wrong. You cannot search for specific dates.

YAHOO!

Strengths: Integrating results with original content – audio, video and images. You can personalise your page, to make the most relevant result to you appear first. **Weaknesses:** User intention. Google gives you show-times in your city, but Yahoo! gives links to irrelevant sites.

YANDEX

Strengths: Localisation. The market leader in Russia, it returns regionally relevant results, whereas Google focuses on countries. **Weaknesses:** With far fewer servers and data centres than Google, it cannot index English-language pages as fast as the Googlebot.



[google infrastructure.jpg](#)

[google.co.uk](#)

3000 x 2000 - A row of servers in Google's data centre in Mayes County, Oklahoma

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describes as, "a process running by [our] side. The perfect assistant."


The success of Apple's Siri - analysts had to revise their sales estimates for the iPhone 4S upwards after its launch, such was consumer enthusiasm - suggests, despite all its technological flaws, says Etzioni, "that people are very eager for that style of interaction, a conversation - just give me that information without ten blue links." Increasingly, it's more than information that we're after. Dyson notes that Bill Gates told her: "the future of search is verbs." People, the argument goes, want search to do things, not just suggest things. With the Knowledge Graph, Google is building a world-historical collection of nouns. But will it help book a restaurant table? Or the cheapest flight? As synonymous as search is with Google, much of our search activity now occurs on apps. As Battelle notes, "the largest issue with search is that we learned about it when the web was young. When the universe was complete, the entire web was searchable," he says.

WORDS SUCH AS 'DOLPHIN'
WILL BE PLACED IN A

100
- DIMENSIONAL

SPACE

"Now our digital lives are utterly fractured - in apps, in walled gardens such as Facebook, across clunky interfaces. Reuniting our digital lives into one platform that is searchable is, to me, the largest problem we face today."

When it's suggested to Singhal that the future of search may not really be "search" at all, but some as yet undefined process, his answer is quick: "I won't get hung up on words," he says. "You can call it whatever you want. This is what the human brain would like to have by its side, when you're seeking information, or sometimes information comes to you without your seeking it." 

Tom Vanderbilt is the author of Traffic: Why We Drive the Way We Do (and What It Says About Us)



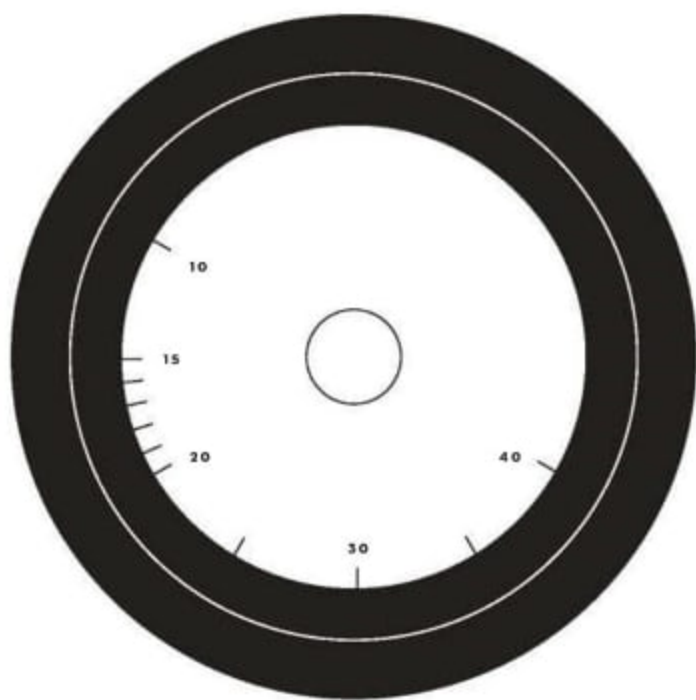
ACTION

BY **TOM CHESHIRE**
ILLUSTRATION:
(THIS SPREAD)
JAMES DAWE

FROM ALIENS TO EXPLOSIONS, MANY OF CINEMA AND TV'S SPECIAL EFFECTS ARE CREATED IN A CORNER OF SOHO IN LONDON. WIRED ASKED THE MAYHEM-MAKERS TO DEPICT THEMSELVES - IN THEIR OWN STYLES



HEROES



On a Soho rooftop in London, Paul Riddle, a visual-effects supervisor at Double Negative, is hanging for his life from a ladder. He's only 20 centimetres above the deck, which is bisected by a line of bright green tape and dotted with five orange crosses to mark where the other board members of Dneg, as the company is known, should stand. In post-production, the ladder will become a Piccadilly building. The purple box that visual-effects (VFX) supervisor Charlie Noble is "surfing" will become a London bus. Each of the five board members will be ten times his normal size, and they'll be beamed down from a massive spaceship. Peter Chiang, the VFX supervisor who has spent the morning and day before making sure all the angles of each portrait line up to create the group shot, is lying on the floor taking the photos: "What we're doing here," says Clay, "is pretty much a simpler version of what we do on set."

Matt Holben and Alex Hope founded Double Negative in June 1998. "There were 30 of us," Holben says. "Now we're 1,100 in London, and 200 in Singapore." The studio has produced visual effects for Christopher Nolan's *Batman* films, the *Harry Potter* series and the last three *Bond* films; in 2011, Dneg won an Oscar for its work on *Inception*.

The firm is part of a Soho cluster that has become one of the world centres for visual effects, alongside LA, Vancouver and Wellington. Standing on the rooftop, Holben points out the headquarters of neighbouring VFX houses Framestore, Cinesite and The Moving Picture Company. "There's great talent and there's always been an incredible culture within London for creativity," Holben says. "The scene started when a client could come in and put a large film into London, and break it up into a number of little chunks." Now, those studios take on whole films themselves. Framestore and The Mill have both won Oscars (in 2008 and 2001 respectively).

Between 2006 and 2008 (the most recent reliable data), visual effects was the fastest growing part of the

UK film industry, with revenues increasing 16.8 per cent, according to a UK government report. The biggest fillip was a young wizard called Harry Potter. "Throughout the eight movies, UK VFX houses were involved in the post-production process," Simon Stanley-Clamp, visual-effects supervisor at Cinesite, says after flipping between the raw footage of upcoming film *World War Z* and Cinesite's CG additions (Before: few zombies. After: many zombies). "With each film a new set of challenges was presented to the UK VFX community and we consistently upped our game. This, combined with the tax breaks, encouraged the big studios to place a percentage of their work in the UK, from shoot to talent."

The Soho VFX scene has benefited from a general trend too: films have grown increasingly reliant on visual effects. Of the 20 highest-grossing movies of all time, 17 relied heavily on visual effects; the other three were entirely CG-animated. At the same time, the cost of technology has come down as its power has increased; all the Soho post-production houses have programmers to create custom software. The challenge will only grow, as films get "bigger, better, faster", according to Stanley-Clamp. Higher frame rates, such as the 48-frames-per-second of *The Hobbit*, and increased resolution mean handling at least twice as much data, which will affect storage structure. "The whole effects pipeline will have to be reworked," Stanley-Clamp. "But big is best."

So, to celebrate this incredible talent pool, WIRED asked six Soho-based VFX houses to create an image showcasing their work – and a few of the people behind some of their best-known films.

Tom Cheshire is associate editor of WIRED. He wrote about Markus "Notch" Persson and Minecraft in 07.12



1. Baseblack 2. The Mill 3. Cinesite 4. Framestore 5. MPC 6. Double Negative



BASEBLACK

STEVE MONCUR / RUDI HOLZAPFEL / CHARLOTTE
TYSON / ROBERT HESKETH / CHRIS PETTS - AND OTHERS

Baseblack may be small, but it's also prolific. Recent films include *Total Recall*, *Dredd 3D*, *Paul*, *Skyfall* and *Harry Potter and the Deathly Hallows: Part 1*, for which it produced more shots than any other VFX studio. For this portrait, Baseblack used Realflow fluid-simulation software to create the waves, and Terragen for depth. baseblack.com



THE MILL

BRYAN BARTLETT / NICOLAS HERNANDEZ /
NICK DREW / WILL COHEN / DOMINIC ALDERSON /
SARA BENNETT / HENNING GLABBART

Doctor Who would look a lot less special without The Mill, which produced effects for the cult BBC series. It won an Oscar for its work on *Gladiator* – notably creating a digital Oliver Reed after the actor died during filming. Recent films include *Snow White and the Huntsman* and *Dredd 3D*. themill.com





CINESITE

HOLGER VOSS / SUE ROWE / MICHELE SCIOLETTE /
SIMON STANLEY-CLAMP / JON NEILL

Cinesite started life in 1991 as a testing site for Kodak. The studio has worked on all eight *Harry Potter* films, creating the detailed scale-model of Hogwarts used in filming. It also contributed 500 shots to *The Golden Compass*, which won a VFX Oscar. It is currently focusing on Brad Pitt's zombie epic *World War Z*. cinesite.com



FRAMESTORE

KEVIN JENKINS / JON COLLINS / SIMON WHALLEY /
WILLIAM SARGENT / TIM WEBBER

Framestore is the grand Oscar-winning dame of Soho. Founded in 1986, the studio is now 786-strong, with offices in New York and LA, and it won an Oscar for *The Golden Compass*. It recently created a computer-generated *Tyrannosaurus rex* for Crunchy Nut Cornflakes. Other clients include Coca-Cola, Volkswagen and Cadbury. framestore.com





DNEG

MATTHEW HOLBEN / PAUL
RIDDLE / PETER CHIANG /
CHARLIE NOBLE / ALEX
HOPE / PAUL FRANKLIN

Double Negative was founded in 1998 with 30 employees; it now has more than 1,000 staff and, in 2009, opened an office in Singapore. The studio has worked on recent features including *John Carter*, *Captain America* and *Skyfall*. Next up: *Man of Steel*, *Les Misérables* and *Captain Phillips*. The company won a Visual Effects Oscar in 2011 for its work on Christopher Nolan's *Inception*, but lost out on a gong in 2012 for *Harry Potter and the Deathly Hallows: Part 2*. dneg.com

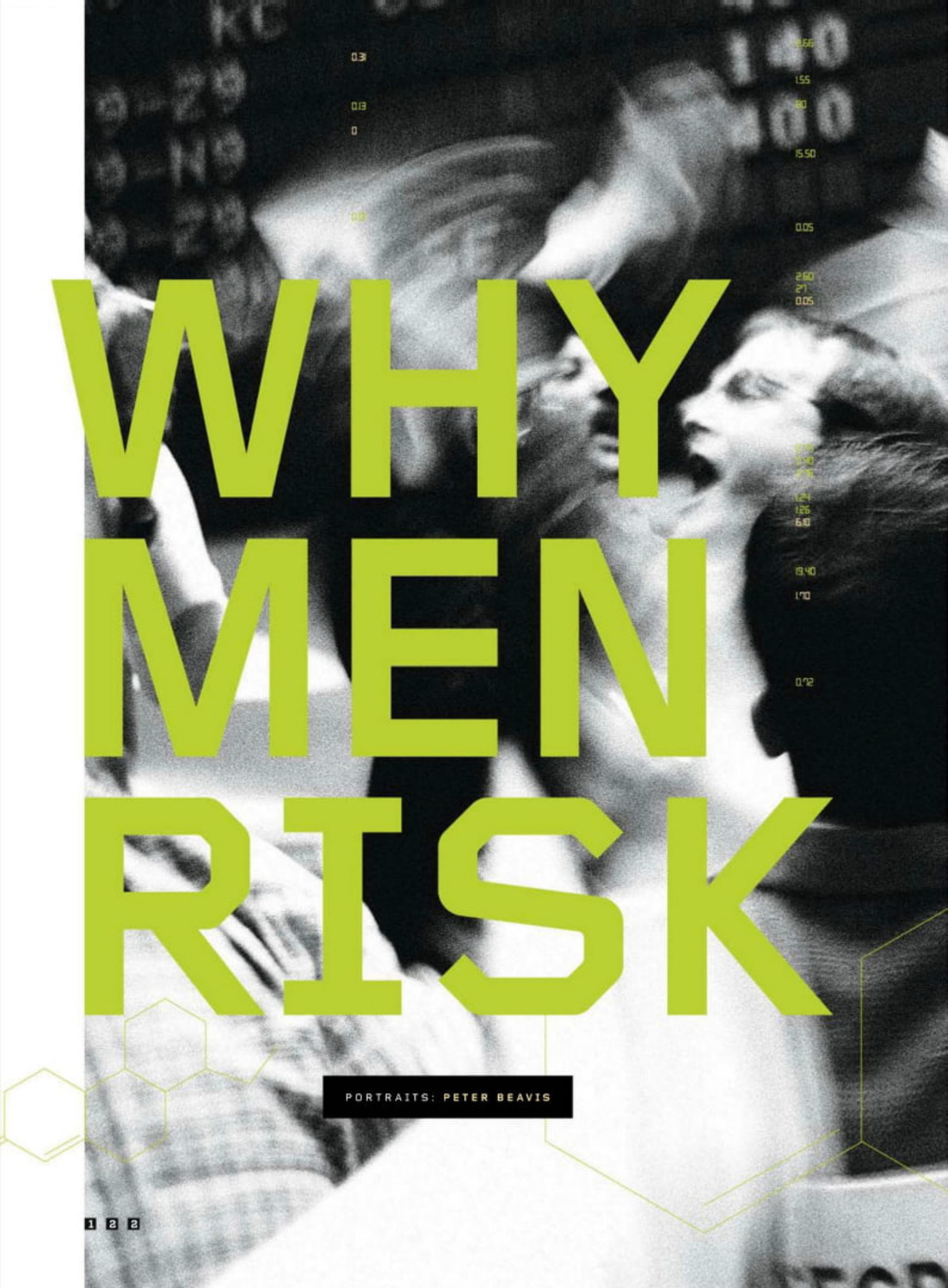




MPC

GARY BROZENICH / JESSICA NORMAN / RICHARD STAMMERS / CHARLEY HENLEY / ANDERS LANGLANDS

Soho-based The Moving Picture Company has offices in LA, Vancouver, New York and Bangalore. The team recently decamped to Iceland and Jordan to film footage for what would become alien planet LV-223 in Ridley Scott's *Prometheus*. The studio focuses on short, viral spots, but its upcoming projects include *Life of Pi* and *World War Z*. moving-picture.com



WHY MEN RISK

PORTRAITS: PETER BEAVIS



JOHN COATES SAYS

TESTOSTERONE SKEWS

FINANCIAL MARKETS.

SHOULD DECISIONS

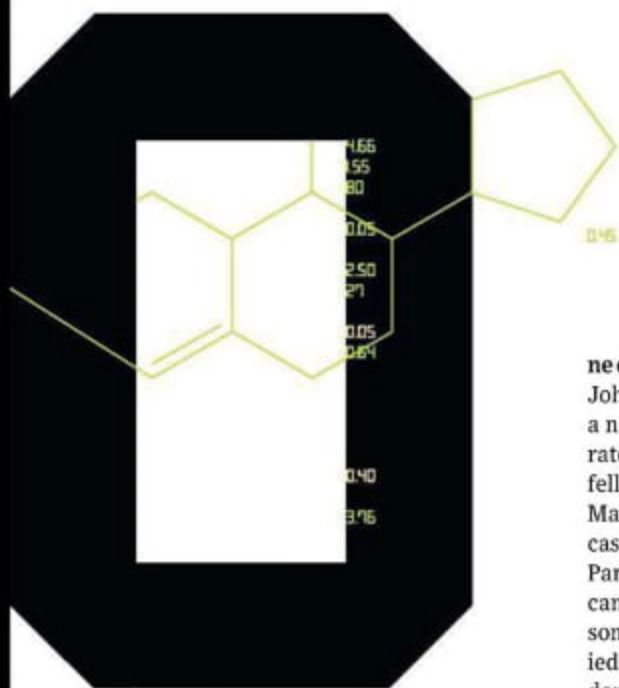
BE LEFT MORE

TO WOMEN?

BY JOÃO MEDEIROS

IT ALL

HOW DO HORMONES SUCH AS TESTOSTERONE
AND CORTISOL AFFECT OUR ABILITY TO WORK,
REST AND PLAY? A STOCK-MARKET TRADER
TURNED NEUROSCIENTIST HAS THE ANSWER



ne day in 2000, a Wall Street trader called John Coates went to visit Linda Wilbrecht, a neuroscience PhD student in the Laboratory of Animal Behaviour at The Rockefeller University on the Upper East Side of Manhattan. Wilbrecht and Coates had met casually six months earlier on a flight from Paris to New York. The two North Americans got talking and soon found they had something in common: they had both studied at Oxbridge. "My life is a series of accidents," Coates tells WIRED. "After studying philosophy, politics and economics [focusing on philosophy] I got a full scholarship to Cambridge. But I was put in the econom-

ics department by mistake - and if I turned the scholarship down, I'd have to reapply the following year. Who turns down Cambridge? After my PhD, I was offered a job at Goldman Sachs because a manager wanted someone to discuss philosophy with. Then I met Linda and she invited me to visit her lab. Oddly, I had no interest whatsoever in the brain at the time."

Coates was unprepared for what he saw. "Within 20 minutes of being in the lab I was hooked," he says. "Hearing the word 'plasticity' applied to the brain horrified and fascinated me." After his first visit, Coates started to attend the neuroscience lecture series at the Caspary Auditorium on the Rockefeller campus. There he saw neuroscientist Bruce McEwen, a pioneer in the study of the effects of hormones on the brain, and primatologist Robert Sapolsky reporting on his work with baboons in Kenya. When the markets were

slow, Coates would nip away from his desk and walk to the neuroscience laboratories, where Wilbrecht would sometimes give him small jobs, such as pipetting samples, and show him how to measure testosterone in serum and how to stain new cells. Gradually, Coates got hooked on experimental science. All his life he had studied purely theoretical subjects such as philosophy and economic theory. He never enjoyed it. Miring himself in a mountain of data, watching the signal emerge from the noise, be it in the laboratory or on the trading floor, was a challenge that he seemed to embrace.

Coates had been working as a trader since 1989. During the 90s, he had been at the centre of the dotcom boom. "It was like watching *A Midsummer Night's Dream*," he says. Traders were euphoric and investors delusional. Few heeded Federal Reserve chairman Alan Greenspan's prescient warning in 1996: "How do we know when irrational exuberance has unduly escalated asset values, which then become subject to unexpected and prolonged contractions, as they have in



John Coates at the London Metal Exchange, one of the workplaces he studies

Canadian-born John Coates is partly bald, with the physique of someone who swims regularly. When Coates talks about his research his manner is passionate and persuasive, his speech interspersed with hearty laughs. He lives in London and works at Cambridge University as a research fellow in finance and neuroscience. In the summer, he leaves Europe to spend holidays with his family in a cabin on a lake in Canada, where only a single phone-line snaking through the woods keeps him in touch with the rest of the world. Every day he writes for hours on end, like a modern-day Henry David Thoreau. "Difference is, Thoreau went to the pub every night," Coates tells me. "Here there's nothing for miles in every direction."

Coates conducted his first study in the financial district of London. At a trading floor in the City, he recruited 17 traders from a mid-sized firm and followed them

Japan over the past decade?" Coates was not even interested in high-tech IPOs, so he was very much an outside observer. "I would see people get on a winning streak on the trading floor and go lunatic. It happened to me as well. For weeks, even months, you feel like the hero of the floor. Every trader who has made money knows what this feels like. You think you're infallible."

Coates felt that while Wall Street was questioning the nature of irrational exuberance, the scientists at Rockefeller were getting close to explaining it. "Economists assumed that all behaviour was conscious and rational," he says. "They were ignoring the fact that signals from the body, both chemical and electrical, affect how we take financial risks."

The more Coates talked to Wilbrecht and her colleagues, the stronger his conviction became that the irrational exuberance he saw on Wall Street was a testosterone-driven phenomenon typical of young males. "John was really interested in why women knew that there was a bubble and were acting sane, and men were out of control," Wilbrecht says. "I was surprised that he was such a feminist. He had all these interesting ideas about testosterone and male behaviour and financial bubbles. I just said, 'Why don't you test your idea?'" Coates wrote a research proposal and circulated it around the department. Encouraged by the feedback, he left Wall Street in 2002 and set out to test the hypothesis that financial instabilities were driven by hormones. So in order to understand financial markets, he had to understand the biology of traders. He returned to Cambridge where, for four years, he studied, among other subjects, endocrinology, physiology and neuroscience. His final year on Wall Street had been his most profitable ever.

for two weeks. The subjects were high-frequency traders who held their bets – which could go up to two billion dollars (£1.25bn) – only for a short period of time, sometimes just for a matter of seconds. Every trader was sitting in front of six or seven computer screens displaying live information on currencies, commodities, bonds, stock-index futures, live news-feeds and ongoing commentary about daily economic statistics by a resident economist. Twice a day the traders would register their profit and loss statement and give saliva samples, from which cortisol – the hormone we release when we are stressed – and testosterone were measured. “I was just looking for preliminary data that would convince me that I wasn’t wasting my time,” says Coates. “I wasn’t fishing for patterns, it was hypothesis-driven. This kind of field work didn’t exist in finance.”

The results were published in a 2008 report in the *Proceedings of the National Academy of Sciences of the United States of America*. Coates found that, on days when traders made an above-average profit, their testosterone levels went up. Most surprisingly, the testosterone levels in the morning predicted how much money the traders would make that day: high levels forecast high earnings. At the same time, the traders’ cortisol was unaffected by how much money they lost. Rather, cortisol levels were sensitive to the volatility in the market, which is a measure of risk and uncertainty. “Cortisol is likely, therefore, to rise in a market crash and, by increasing risk aversion, to exaggerate the market’s downward movement,” the report states. “Testosterone, on the other hand, is likely to rise in a bubble and, by increasing risk-taking, to exaggerate the market’s upward movement. These steroid feedback loops may help to explain why people caught up in bubbles and crashes often find it difficult to make rational choices.”

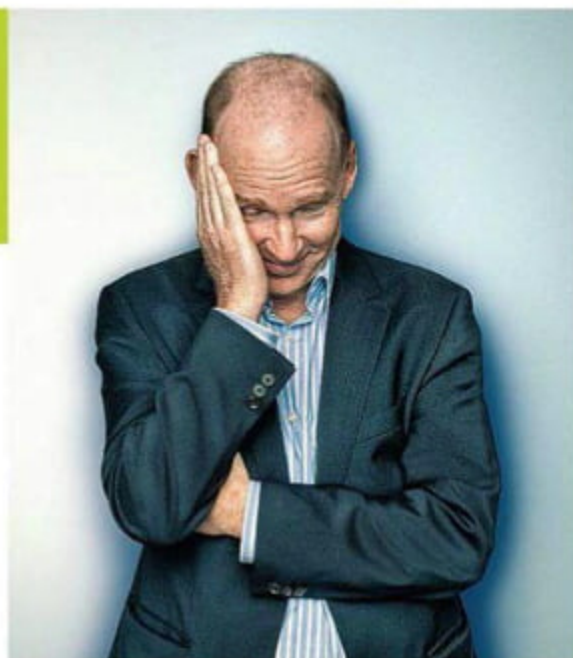
Coates first learned of steroid feedback loops during his regular visits to Rockefeller University. The testosterone feedback loop is known as the winner effect. The winner effect had been observed in nature for many different species, from cichlid fish to rhesus monkeys, and its physiology is well understood. When two animals square off in anticipation of a fight, they experience a rise in testosterone levels. This self-doping mechanism prepares the animal for competition, increasing the blood’s capacity to carry oxygen, quickening the speed of reactions, and, via its effect on the brain, increasing fearlessness and appetite for risk. In the aftermath, winners can emerge with a tenfold increase in the amount of testosterone circulating in their bodies, whereas losers’ testosterone levels can be suppressed by the same order of magnitude.

This doping effect can sometimes last for months. Nature primes winners to keep winning and losers to keep losing. The winner effect is not exclusive to the savannah. Sports scientists have observed it in tennis, rugby, football and even chess. Winning athletes experience a post-game spike in testosterone. Even the fans of winning teams vicariously experience a testosterone surge. “Many economists dispute it,” Coates says. “They seem completely unaware of the animal studies. They say that anyone who believes in the winner effect is suffering a cognitive bias, but they never mention what happens with

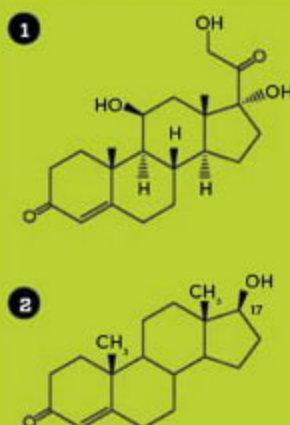
our physiology. We do have a self-doping mechanism lurking in our bodies and any sports scientist will tell you that rising levels of testosterone contribute to victory.”

In a recent study, Coates analysed a database of 623,000 professional tennis matches, narrowing the sample down to matches between tennis players who were as closely matched as possible in rank and to matches that went to a tie break

Coates wrestles with his hormone levels, London, November 2012



Those hormones in full: The chemical structure of (1) cortisol and (2) testosterone



decided by the narrowest possible margins – two points. “These matches were played so closely that they could have been won by a gust of wind, a cough in the stand,” Coates says. He found that, for the men, the winners of the first set had a 60 per cent chance of winning the match. The statistics didn’t show any correlation for the women players. “The protocol was a very clean test of a pure winner effect. That we didn’t see it for women indicates it is probably a testosterone effect. The data was eye-popping.”

Women produce, on average, about ten per cent of the amount of testosterone that men generate. According to Coates, they may therefore be less prone to excessive risks driven by the winner effect; their stress response may also be less sensitive to risk-taking failures.

During the dotcom boom, it always surprised Coates that the women traders seemed to be relatively immune to the euphoria that engulfed most male traders at the time. Women seemed to know

that a storm was coming. When it comes to the financial markets, Coates says, men are more hormonal than women. Male physiology makes men more attuned to high-frequency risk-taking. "Our latest studies suggest that women are not more risk averse than men," says Coates. "They merely prefer to have more time and information before they take risks." This doesn't imply smaller profits – quite the opposite, in fact. Studies of gender differences in investment behaviour consistently show that, in the long term, female investors consistently outperform their male counterparts. This is not, Coates stresses, an endorsement of one sex over another. "It's not that one group is better than the other," says Coates. "They're different. It's just that by diversifying the biology of the trading floor you would counterbalance the extreme tendencies."

CONTROL YOUR CORTISOL, MANAGE YOUR STRESS

Stress is a physiological response that prepares our body for physical action. Short-lived stress helps us survive. Over the long term, it can kill. "A lot of times, the problem is that our conscious brain is disconnected from our stress response," says John Coates. In those cases, a talking cure for stress is useless. If you want to manage stress, then you have to manage your physiology.

EXERCISE



Doctors always tell us to get more exercise. They're right: physical stress helps develop resilience to mental stress. But exercises need to be tailored to the individual. "Every type of exercise has a different effect, whether it's anaerobic or aerobic, high impact or fun," says Coates.

WORKPLACE



Novelty, uncertainty and uncontrollability are all stress triggers. "In work, management has a huge influence on our stress levels," says Coates. "I don't think managers are aware of that." He says companies should devolve more control to workers over what projects they work on.

BODY TEMP



Thermoregulation – the ability to regulate our own body temperature – can be affected by central heating and air-con. The solution? Expose yourself to cold weather or take a cold swim. "Thermal stress can actually help emotional stability," says Coates.

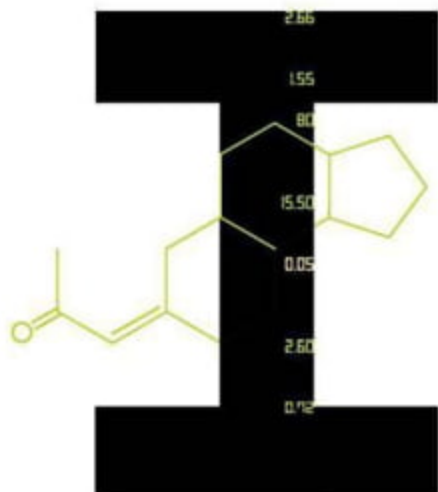
contemplating leaving Wall Street at that point, but Sapolsky's description of young baboons getting bullied by their seniors sounded too familiar. "During a crisis, middle managers at the bank behave like a stressed-out troop of primates," says Coates. "Bosses bully their juniors just like adult male baboons bite their juniors to relieve their stress. Some bosses think that they are not doing their job unless everyone is in a state of constant panic."

When people feel stressed, a region of the brain triggers the release of cortisol, a hormone that puts the body in heightened state of alert. Cortisol mobilises nutrients into your bloodstream, rapidly increases its levels of glucose, providing muscles with a burst of energy, it shuts down all nonessential bodily processes, such as digestion, the reproductive system and the production of testosterone. An acute cortisol response to a challenge is fundamental to survival. However, the stress response was designed to be short-lived. The problem arises when stress does not go away and cortisol builds up in your body over months and years. In the 70s, neuroscientists found that if you repeatedly expose lab mice to uncontrollable stressors, such as electric shocks, after

a while they will fail to leave their cages even if the door is left open. Biologists call this state "learned helplessness". It's a stark illustration of the extent to which high levels of cortisol can dramatically change our brain and subsequently our behaviour: you feel you no longer have control over your own fate, even if a way out is right in front of you. You become risk-averse and despondent. You give up. "It's so dysfunctional it seems like a flaw in evolution," Coates says.

For him, the tragedy is that we become used to thinking that stress is all in our head, when in fact, it might be our body. "In therapy, we are talked into seeing stress as a challenge, not a threat. I'm not convinced talking gets at the physiology. If the demands made on you are greater than your resources – you are going to get stressed and no amount of talk therapy is going to change that equation."

In the same way that testosterone can drive financial bubbles, Coates believes that high levels of cortisol on the trading

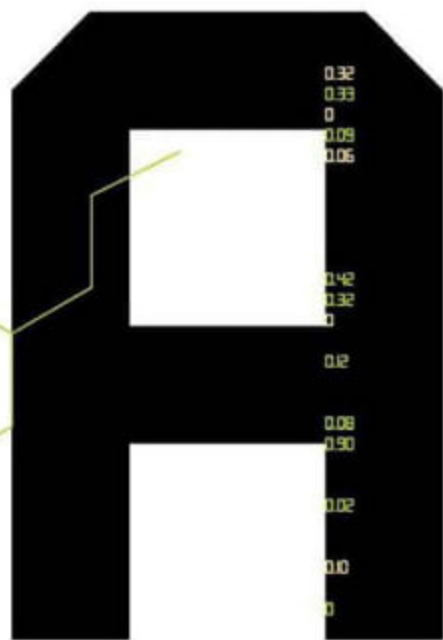


in his second year as a junior trader at Goldman Sachs in Toronto, Coates had a bad losing streak. Quebec, Canada's largest province, was having an independence referendum. Canadian bonds were devaluing, so Coates bought Canadian bonds and sold US bonds against them. He was confident that he was making the right trade. "I lost \$22 million, which was a hell of a lot for a junior trader," he says. He stopped sleeping. He began to obsess about market rumours. New York started to look like Gotham City. "I became absolutely insane. My world fell apart."

The stress response is a problem that preoccupies Coates more than the problem of irrational exuberance. He was captivated, 13 years ago, by the ideas of Robert Sapolsky, a primatologist who first made the link between low social

status and high levels of stress. Sapolsky had studied neuroendocrinology under Bruce McEwen at Rockefeller and, after that, spent nearly 30 years studying the social behaviour of baboon troops in Kenya. In 2000, while still on Wall Street, Coates heard a lecture by Sapolsky on his work with the baboons and, he recalls, left the room "knowing that was something I was going to end up working on". He wasn't even

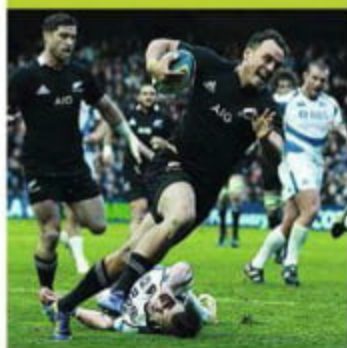
floor can amplify periods of irrational pessimism. Coates is currently running experiments to understand if traders too can be afflicted by learned helplessness during a crisis and how cortisol can affect financial decisions. At Addenbrooke's Hospital in Cambridge, he recruited volunteers and, by administering tablets, artificially raised their cortisol levels by about 55 per cent over a period of ten days – the state of someone who is moderately stressed. He then had them play a game that gauged their risk preferences before and after their cortisol levels were raised. "It absolutely nuked their appetite for risk," Coates says. "By manipulating the level of cortisol in their bodies, we can almost tune how risk averse people are. Stress hormones act like a dial. In economics, there's an unstated assumption that our risk preferences are innate. This suggests the opposite. Our risk preferences fluctuate with the state of the body."



t the core of Coates's hypothesis – that testosterone is the molecule of irrational exuberance and cortisol the molecule of irrational pessimism – lies a deeper, more challenging idea: that a lot of the decisions that we assume are conscious processes are actually strongly manipulated by signals from our bodies. This is an idea that has been explored in detail by sports physiologist Christian Cook, who is considered a pioneer in the study of hormones in athletic performance. In the early stages of his career, he studied the effect of human encroachment in the stress levels of exotic and domestic animals, from sheep to polar bears. He then worked as a physiologist for the New Zealand rugby team and America's Cup Yachting, where he looked at ways for athletes to optimise their training and studied the role of natural hormones in athletes' recovery from intense exercise.

"In the early noughties we still had the stereotypical vision of the balloon-muscled man introducing 100 times his normal physiological levels of testosterone into his body," he says. "It biased our thinking and people assumed testosterone only makes muscle."

Professional athletes have to recover from physical and mental stress particularly quickly



This picture, however, was too simplistic. "Obviously, if you put that much testosterone into your body your muscles will grow. But within a normal biological range, its main direct role is behavioural. Testosterone gives you more confidence and motivation and that makes you work harder, which indirectly influences muscle growth." The role of testosterone, he found, was not so much that it gives you something extra for free, but that it allows you to express more of what you're capable of. If you have higher levels of testosterone you can jump higher and pull more weight not necessarily because you have more muscle power, but because your hormonal levels allow you to express that power more freely. Cook speculates that this is the reason some athletes still use steroids: they have become psychologically addicted to the feeling of confidence they get from the artificial testosterone.

These findings neatly corroborate the animal studies on the winner effect. But when it comes to humans, Cook makes another, subtler point. Testosterone is not related to winning. It's related to our perception of winning. In one of his studies, Cook took a group of highly trained rugby players and gave the coach a shortlist of standard phrases from which to choose, such as "You did that poorly, why couldn't you do that right?" or "Well done, that's how you do it, you performed really well." Half the group received a positive feedback, the coach positively reinforcing things that were done well, whereas the other half listened to the coach negatively reinforcing things that had been done badly. Players who received positive feedback had a 30 per cent higher testosterone response than the players who'd received negative feedback. This effect lasted several days until the next match, when the players who had had positive feedback performed better than the players who got criticised.

"What we found in rugby is that you could be recovered physically but not be ready to compete," says Cook. "Recovery is far more than the ability to physically perform. It's also the ability to mentally make yourself perform." This optimal state – what Cook calls "readiness to compete" – is dependent on the player's hormonal balance and appropriate recovery. Training programmes are designed to be intermittently stressful. Any kind of physical exertion is accompanied by a release of cortisol in the body, which allows it to more quickly mobilise the necessary nutrients to the working muscle tissues. Once that stress response is turned off, the body turns on a testosterone

response to cope with the stress and rebuild energy stores. The body adapts to the physical stress through a rhythmic alteration between a period of physical loading followed by a period of recovery and adaptation. That adaptation increases an individual's capacity to handle stress. Elite athletes have an unusual ability to cope with challenges: their initial stress response is strong, but abates quickly.

Cook is keen to stress that testosterone and cortisol are part of a complex system that dictates how we respond to stress. This stress can be alleviated – by exercise, for example – but it is far from a panacea. “Exercise promotes physiological resilience, but it’s pointless to say, ‘Go exercise,’” he says. “People’s bodies respond differently. A lot of our training is wrong because it enforces the same programme for everyone. It’s what I call ‘survival of the fittest’, but it’s not necessarily survival of the best.”



During his first experiment with financial traders, in addition to the physiological data that he collected, Coates would hand them multiple-choice questionnaires about their day at the trading floor, their health and their concerns. They turned out to be useless. “One trader didn’t even use the multiple-choice answers available. He just wrote down ‘euphoric, stressed, fucked off, despondent,’” Coates recalls. “That page alone was worth keeping as a testament to the inability of questionnaires to get at anything precise.” Traders could not interpret or explain their own financial bets during the day. Their cortisol levels, on the other hand, mimicked with astonishing precision the degree of volatility in the markets. “Psychologists often don’t think about the brain and neuroscientists often don’t think about the rest of the body,” Bruce McEwen says. “People have to realise that hormones are not only controlled by the brain, they *act on* the brain. They affect all sorts of behaviours – certainly trading.”

Coates sees it as his mission to spread the notion that in order to understand our own behaviour we have to understand our own biology. Economists, Coates writes, tend to view the assessment of financial risk as a purely intellectual affair, but we prepare for financial risk physically by bringing forth a biological reaction. When this happens to traders, they come to suffer an irrational exuberance or pessimism. “As a result,” he writes in his book, *The Hour Between Dog and Wolf*, “traders are walking time-bombs, and banks invariably light the fuse, dangling huge risk limits and bonus payments that have exceeded \$100 million.”

Physiologist Christian Cook at the Sports Training Village at Bath University

The elegance of Coates’s pioneering studies is that he was able to cut through the messy nature of our physiology and provide clear relationships between objective and yet disparate measures from the universe of high finance, and our interior hormonal world; how market volatility is connected to cortisol and how profit and loss statements are connected to testosterone. “John’s work most closely matches my work with wild baboons in Kenya,” Robert Sapolsky says. “It’s based on subjects in the real world rather than some artificial experimental setting. His interpretations are smart, subtle and appropriately careful. What I like about his work is that he is showing that, yes, external events such as absolute numbers in stock-market outcomes can impact physiology, but that the meaning of those events do so more powerfully.”

Coates is currently running eight experiments, spanning a range of topics from difference in risk-taking between men and women, to the study of stress in the workplace. He is adamant that a deeper understanding of our physiology should inform not just how we manage our trading floors, but also how we design all workplaces. His understanding of physiology is why he contends that trading floors should be spaces with biological diversity, populated by both young and old, male and female – and why he also believes that bank management should extend its period of assessment from one to five years.

The fundamental lesson is that there is no such thing as a pure human intellect that is not tainted by the hormonal waves and other signals that arise from the rest of the body. Traders on Wall Street, Olympic athletes and baboons in Kenya are just the extreme examples of the one biology that pervades us all. “As a species, we share the same biology with other animals, but express it uniquely,” Sapolsky said during a lecture at Stanford University in 2010. “We can have two humans sitting at a table doing nothing more physically taxing than one of them moving a little piece of wood on the table. And if it happens that these two individuals are at a chess tournament, then they are able to keep [up] a blood pressure for six hours [at a level] that you normally only see in a marathon runner, while doing nothing more than thinking. And this is outrageous because when you look at these chess Grand Masters who’ve just taken down an opponent, they will have the exact same physiology of some wild baboon in the savannah who has just ripped open the stomach of his worst rival.”

João Medeiros wrote about performance in sport in issue 07.12

They took my photos,

my email,

my files.

H A C



Passwords have failed.

It's time to try something new.

BY MAT HONAN

PHOTOGRAPHY: ETHAN HILL



KED

YOU HAVE THAT CAN YOUR

IT'S NOT A WELL-KEPT SECRET, EITHER. Just a string of characters – maybe six if you're careless, 16 if you're cautious – that can reveal everything.

Your email. Your bank account. Your address and credit-card number. Photos of your kids or, worse, of yourself, naked. The precise location where you're sitting right now as you read these words. Since the dawn of the information age, we've bought into the idea that a password, so long as it's elaborate enough, is an adequate means of protecting all this precious data. But in 2012 that's a fallacy, a fantasy, an outdated sales pitch. And anyone who still mouths it is a sucker – or someone who takes you for one.

No matter how complex or unique, your passwords can no longer protect you.

Look around. Leaks and dumps – hackers breaking into computer systems and releasing lists of usernames and passwords on the open web – are now regular occurrences. The way we daisy-chain accounts, with our email address doubling as a universal login, creates a single point of failure that can be exploited with devastating results. Thanks to an explosion of personal information being stored in the cloud, tricking customer-service agents into resetting passwords has never been easier. All a hacker has to do is use personal information that's publicly available on one service to gain entry into another.

This summer, hackers destroyed my entire digital life in the span of an hour. My Apple, Twitter, and Gmail passwords were all robust – seven, ten and 19 characters respectively, all alphanumeric, some with symbols thrown in as well – but the three accounts were linked, so once the hackers had conned their way into one, they had them all. They really just wanted my Twitter handle: @mat. As a three-letter username, it's considered prestigious. And to delay me from getting it back, they used my Apple account to wipe every one of my devices, my iPhone and iPad and MacBook, deleting all my messages and documents and every picture I'd ever taken of my 18-month-old daughter.

Since that awful day, I've devoted myself to researching the world of online security. And what I have found is utterly terrifying. Our digital lives are simply too easy to crack. Imagine that I want to get into your email. Let's say you're on AOL. All I need to do is go to the website and supply your name plus maybe the city you were born in, info that's easy to find in the age of Google. With that, AOL gives me a password reset and I can log in as you.

So, what's the first thing I do? Search for the word "bank" to figure out where you do your online banking. I go there and click on the "Forgot Password?" link. I get the password reset and log in to your account, which I control. Now I own your bank account as well as your email.

This summer I learned how to get into, well, everything. With two minutes and \$4 (£2.50) to spend at a sketchy foreign website, I could report back with your credit card, phone and Social Security numbers, and your home address. Allow me five minutes more and I could be inside your accounts for, say, Amazon, Best Buy, Hulu, Microsoft and Netflix. With yet ten more, I could take over your AT&T, Comcast, and Verizon. Give me 20 – total – and I own your PayPal. Some of those security holes are plugged now. But not all – and new ones are discovered every day.

The common weakness in these hacks is the user's password. It's an artefact from a time when our computers were not hyper-connected. Today, nothing you do, no precaution you take, no long or random string of characters can stop a truly dedicated and devious individual from cracking your account and clearing you out. The age of the password has come to an end; we just haven't realised it yet.

Passwords are as old as civilisation. And for as long as they've existed, people have been breaking them.

In 413 BC, at the height of the Peloponnesian War, the Athenian general Demosthenes landed in Sicily with 5,000 soldiers to assist in the attack on Syracuse. Things were looking good for the Greeks. Syracuse, a key ally of Sparta, seemed sure to fall.

But during a chaotic nighttime battle at Epipole, Demosthenes's forces were scattered, and while attempting to regroup they began calling out their watchword, a prearranged term that would identify soldiers as friendly. The Syracusans learned of the code and passed it quietly through their ranks. At times when the Greeks looked too formidable, the watchword allowed their opponents to pose as allies. Employing this ruse, the Syracusans decimated the invaders, and when the Sun rose, their cavalry mopped up the rest. It was a turning point in the war.

The first computers to use passwords were likely those in MIT's Compatible Time-Sharing System (CTSS), developed in 1961.

A SECRET RUIN LIFE.

To limit the time any one user could spend on the system, CTSS used a login to ration access. It only took until 1962 when a PhD student named Allan Scherr defeated the login with a simple hack: he located the file containing the passwords and printed out all of them. After that, he got as much time as he wanted.

During the formative years of the web, passwords worked pretty well. This was due largely to how little data they actually needed to protect. Our passwords were limited to a handful of applications: an ISP for email and maybe an e-commerce site or two. Because

almost no personal information was in the cloud – the cloud was barely a wisp at that point – there was little payoff for breaking into an individual's accounts; the serious hackers were still going after big corporate systems. So we were lulled into complacency. Email addresses morphed into a sort of universal login, serving as our username just about everywhere. This practice persisted even as the number of accounts – the number of failure points – grew exponentially. Web-based email was the gateway to a new slate of cloud apps. We began banking in the cloud, tracking our finances in the cloud and doing our taxes in the cloud. We stashed our photos, our documents, our data in the cloud.

Eventually, as the number of epic hacks increased, we started to lean on a curious psychological crutch: the notion of the “strong” password. It's the compromise that web companies came up

with to keep people signing up and entrusting data to their sites. It's the sticking plaster that's being washed away in a river of blood.

Every security framework needs to make two major trade-offs to function in the real world. The first is convenience: the most secure system isn't any good if it's a pain

“Cosmo”, a teenage hacker in Long Beach, California, used social-engineering exploits to crack accounts at Amazon, AOL, AT&T, Microsoft, Netflix and PayPal



A PASSWORD HACKER IN ACTION

The following is from a January 2012 live chat between Apple online support and a hacker posing as "Brian" – a real Apple customer. The hacker's goal: resetting the password and taking over the account.

APPLE: Can you answer a question from the account? Name of your best friend?

HACKER: I think that is "Kevin" or "Austin" or "Max".

APPLE: None of those answers are correct. Do you think you may have entered last names with the answer?

HACKER: I don't think so. I've provided the last four [card-card numbers], is that enough?

APPLE: The last four are incorrect. Do you have another credit card?

HACKER: Can you check again? I'm looking at my Visa here, the last four is "5555".

APPLE: Yes, I have checked again. 5555 is not what is on the account. Did you try to reset online and choose email authentication?

HACKER: Yes, but my email has been hacked. I think the hacker added a credit card to the account, as many of my accounts had the same thing happen to them.

APPLE: You want to try the first and last name for the best friend question?

HACKER: Be right back. The chicken is burning, sorry. One second.

APPLE: OK.

HACKER: Here, I'm back. I think the answer might be Chris? He's a good friend.

APPLE: I am sorry, Brian, but that answer is incorrect.

HACKER: Christopher Aylsworth is the full name. Another possibility is Raymond McAlister.

APPLE: Both of those are incorrect as well.

HACKER: I'm just gonna list off some friends that might be. Brian Coca. Bryan Yount. Steven May...

APPLE: How about this. Give me the name of one of your custom mail folders.

HACKER: "Google" "Gmail" "Apple" I think. I'm a programmer at Google.

APPLE: OK, "Apple" is correct. Can I have an alternate email address for you?

HACKER: The alternate email I used when I made the account?

APPLE: I will need an email address to send you the password reset.

HACKER: Can you send it to "toe@aol.com"?

APPLE: The email has been sent.

HACKER: Thanks!

to access. A 256-character hexadecimal password might keep your data safe, but you're no more likely to get into your account than anyone else. Better security is easy if you're willing to inconvenience users, but that's not a workable compromise.

The second trade-off is privacy. If the whole system is designed to keep data secret, users will hardly stand for a security regime that shreds their privacy. Imagine a safe that has no key or a password, because security techs are in the room, watching it 24/7, and they unlock the safe whenever they see that it's you. Without privacy, we could have perfect security, but no one would accept a system like that.

For decades now, web companies have been terrified by both trade-offs. They have wanted the act of signing up and using their service to seem both totally private and perfectly simple – the very state of affairs that makes adequate security impossible. So they've settled on the strong password as the cure. Make it long enough, throw in some caps and numbers, and everything will be fine.

But for years it hasn't been fine. In the age of the algorithm, when our laptops pack more processing power than a high-end workstation did a decade ago, cracking a long password with brute-force computation takes just a few million extra cycles. That's not even counting the new hacking techniques that simply steal our passwords or bypass them entirely – techniques that no password length or complexity can ever prevent. The number of data breaches in the US increased by 67 percent in 2011, and each major breach is enormously expensive: after Sony's PlayStation account database was hacked in 2011, the company had to shell out \$171 million to rebuild its network and protect users from identity theft. Add up the total cost, including lost business, and a single hack can become a billion-dollar catastrophe.



HOW DO OUR ONLINE PASSWORDS FALL?

In every imaginable way: they're guessed, lifted from a password dump, cracked by brute force, stolen with a keylogger or reset by conning a company's customer-support department.

Let's start with the simplest hack: guessing. Carelessness, it turns out, is the biggest security risk of all. When security consultant Mark Burnett compiled a list of the 10,000 most common passwords based on easily available sources (such as passwords dumped online by hackers and simple Google searches), he found the number-one password people used was,

yes, "password". The second most popular? "123456". Free software tools with names such as Cain and Abel or John the Ripper automate password-cracking to such an extent that any idiot can do it. All you need is an internet connection and a list of common passwords – readily available in handy database formats.

What's shocking isn't that people still use such terrible passwords, it's that some companies allow it. The same lists that can be used to crack passwords can also be used to make sure no one is able to choose those passwords in the first place. But saving us from our bad habits isn't nearly enough to salvage the system.

Our other common mistake is password reuse. During the past two years, more than 280 million "hashes" (encrypted but crackable passwords) have been dumped online for everyone to see. LinkedIn, Yahoo!, Gawker and eHarmony all had security breaches in which the usernames and passwords of millions of people were stolen and then dropped on the open web. A comparison of two dumps found that 49 percent of people had reused usernames and passwords between the hacked sites.

"Password reuse is what really kills you," says Diana Smetters, a software engineer at Google who works on authentication systems. "There is a very efficient economy for exchanging that information." Your login may have already been compromised, and you might not know it – until an account is destroyed.

Hackers also get our passwords through trickery. The most well-known technique is phishing, which involves mimicking a familiar site and asking users to enter their login information. Steven Downey, CTO of Shipley Energy in Pennsylvania, describes how this technique compromised the online account of one of his company's board members. The executive had used a complex alphanumeric password to protect her AOL email, but was tricked into freely giving it up.

The hacker phished his way in: he sent her an email that linked to a bogus AOL page, which asked for her password. She entered it. After that he did nothing. At first, that is. The hacker just lurked, reading all her messages and getting to know her. He learned where she banked and that she had an accountant who handled her finances. He even learned her electronic mannerisms, the phrases and salutations she used. Only then did he pose as her and send an email to her accountant, ordering three separate wire transfers totalling \$120,000 to a bank in Australia. Her bank at home sent \$89,000 before the scam was detected.

Even more sinister is malware: hidden programs that secretly send your data to other people. According to a Verizon report, malware attacks accounted for 69 per cent of US data breaches in 2011. Malware commonly installs a keylogger or some other spyware. Its targets are often large organisations, where the goal is not to steal one or a thousand passwords, but to access an entire system.

One example is Zeus, a piece of malware that first appeared in 2007. Clicking a link, usually in a phishing email, installs it on your computer. Then it waits for you to log in to an online banking account: Zeus grabs your password and sends it to the hacker. In a single case in 2010, the FBI helped apprehend five people in Ukraine who had employed Zeus to steal \$70 million from 390 victims, primarily small businesses in the US. "Hackers are going after small businesses," says Jeremy Grant, who runs the US Department of Commerce's National Strategy for Trusted Identities in Cyberspace,

which is figuring out how to get us past the current password regime. "They have more money than individuals and less protection than large corporations."

If our problems with passwords ended there, we could probably save the system. We could ban poor passwords and discourage reuse. We could train people to outsmart phishing attempts. We could use antivirus software to root out malware.

But we'd be left with the weakest link of all: human memory. Passwords need to be hard in order not to be routinely cracked or guessed. So if your password is any good at all, there's a very good chance you'll forget it. Because of that, every password-based system

needs a reset mechanism. And the inevitable trade-offs (security vs privacy vs convenience) mean that recovering a forgotten password can't be too onerous. That's what opens your account to being easily overtaken via social engineering. Although "socialing" was responsible for just seven per cent of the hacking cases that US government agencies tracked in 2011, it raked in 37 per cent of the total data stolen.

Socialing is how my Apple ID was stolen this past summer. The hackers persuaded Apple to reset my password by calling the helpline and using my address details and the last four digits of my credit card. As I had designated my Apple mailbox as a backup for my Gmail account, the hackers could reset that too, deleting eight years of email and documents. They posed as me on Twitter and posted racist and anti-gay diatribes there.

After my story set off a wave of publicity, Apple changed its practices: it temporarily quit issuing password resets over the phone. But you could still get one online. And so a month later, a different exploit was used against *New York Times* technology columnist David Pogue. The hackers were able to reset his password online by getting past his "security questions".

To reset a lost login, you need to supply answers to questions that (supposedly) only you know. Pogue had picked (1) What was your first car? (2) What is your favourite model of car? and (3) Where were you on January 1, 2000? Answers to the first two were available on Google: he had written that a Corolla had been his first car, and had recently praised his Toyota Prius. The hackers simply took a wild guess on the third question: "party". Lots of people use that one.

Matthew Prince (below) protected his Google Apps account with a second code that would be sent to his phone – so the hackers got his mobile account



THE AGE
OF THE
PASSWORD IS
OVER;

WE JUST
HAVEN'T
REALISED
IT YET

With that, the hackers were in. They dove into his address book (he's pals with magician David Blaine!) and locked him out of his kitchen iMac.

You might think "that could never happen to me": David Pogue is a prolific writer for the major media whose every brainwave goes online. But have you thought about your LinkedIn account? Your Facebook page? Your kids' pages or your friends' or family's? If you have a serious web presence, your answers to the standard questions – still often the only options available – are trivial to root out. Your mother's maiden name is on Ancestry.com, your school mascot is on Classmates, your birthday is on Facebook and so is your best friend's name.

The ultimate problem with the password is that it's a single point of failure, open to many avenues of attack. We can't possibly have a password-based security system that's memorable enough to allow mobile logins, nimble enough to vary from site to site, convenient enough to be easily reset and yet also secure against brute-force hacking. But today that's exactly what we're banking on.



WHO IS DOING THIS? THE ANSWER breaks down into two main groups: syndicates and bored teenagers.

The syndicates are scary because they're efficient and wildly prolific. Malware and virus-writing used to be something hobbyist hackers did for fun. Not any more. Sometime around the mid-2000s, organised crime took over. Today's virus writer is more likely to be a professional criminal operating out of the former Soviet Union than some

kid in a university dorm room. There's a good reason for that: money. In 2011 Russian-speaking hackers alone made an estimated \$4.5 billion from cyber-crime – no wonder the practice has become organised. Moreover, they are targeting not just businesses and financial institutions, but individuals too. Russian cybercriminals took in tens of millions of dollars from individuals last year.

But teenagers are, if anything, scarier, because they're so innovative. The groups that hacked David Pogue shared a common member: a 14-year-old who goes by the handle "Dictate". He calls companies or chats with them online, asking for password resets. He and others like him start by looking for information about you that's publicly available: your name, email and home address, for example, which are easy to get from sites like Spokeo and WhitePages.com. Then he uses that data to reset your password in places such as Hulu and Netflix, where billing information, including the last four digits of your credit-card number, is kept visibly on file. Soon, through patience and trial and error, he'll have your email, your photos, your files – just as he had mine.

Why do kids like Dictate do it? Mostly just for lulz. One favourite is to anger people by posting racist or offensive messages on their personal accounts. As Dictate explains, "Racism invokes a funnier reaction in people. Hacking, people don't care. When we jacked @jennarose3xo [AKA Jenna Rose, a teen singer whose videos got widely hate-watched in 2010], I got no reaction from just tweeting that I jacked her stuff. We got a reaction when we uploaded a video of some black guys and pretended to be them." Apparently, sociopathy sells.

A lot of these kids came out of the Xbox hacking scene, where the networked competition of gamers encouraged kids to learn cheats to get what they wanted. In particular they developed techniques to steal so-called OG (original gamer) tags – the simple ones, such as "Dictate" instead of "Dictate27098" – from the people who'd claimed them first. One hacker was "Cosmo" – one of the first to discover many of the most brilliant socializing exploits out there, including those used on Amazon and PayPal. ("It just came to me," he said with pride when I met him a few months ago at his grandmother's house in southern California.) In early 2012, Cosmo's group, UGNazi, took down sites including Nasdaq, the CIA and 4chan. When the FBI finally arrested this shadowy figure in June, they found that he was just 15 years old; when he and I met a few months later, I had to drive.

HOW TO SURVIVE THE PASSWORD APOCALYPSE

Until we figure out a better system for protecting our stuff online, here are four mistakes you should never make – and four moves that will make your accounts harder (but not impossible) to crack. MH

DON'T

- ▶ **REUSE PASSWORDS** If you do, a hacker who gets into just one of your accounts will own them all.
- ▶ **USE A DICTIONARY WORD AS YOUR PASSWORD** If you must, then string several together into a pass phrase.
- ▶ **USE STANDARD NUMBER SUBSTITUTIONS** Think "P455w0rd" is a good password? N0p3! Cracking tools now have those built in.
- ▶ **USE A SHORT PASSWORD** no matter how weird. Today's processing speeds mean that even passwords like "h6lr\$q" are quickly crackable. Your best defence is the longest possible password.

It's precisely because of the relentless dedication of kids such as Dictate and Cosmo that the password system cannot be salvaged. You can't arrest them all, and even if you did, new ones would keep growing up.

For the same reason, many of the silver bullets that people imagine will supplement – and save – passwords are vulnerable as well. For example, in March 2011 hackers broke into the security company RSA and stole data relating to its SecurID tokens, supposedly hack-proof devices that provide secondary codes to accompany passwords. RSA never divulged just what was taken, but it's widely believed that the hackers got enough data to duplicate the numbers the tokens generate. If they also learned the tokens' device IDs, they'd be able to penetrate the most secure systems in corporate America.

On the consumer side, take Google's two-factor authentication for Gmail. It works like this: first you confirm a mobile-phone number with Google. After that, whenever you try to log in from an unfamiliar IP address, the company sends a code to your phone: the second factor. Does this keep your account safer? Absolutely. Will it save passwords from obsolescence? Let me tell you about what happened to Matthew Prince.

This past summer UGNazi decided to go after Prince, CEO of a web performance and security company called

DO

- ▶ **ENABLE TWO-FACTOR AUTHENTICATION WHEN OFFERED** When you log in from a strange location, a system such as this will send you a text message with a code to confirm. Yes, that can be cracked, but it's better than nothing.
- ▶ **GIVE BOGUS ANSWERS TO SECURITY QUESTIONS** Think of them as a secondary password. Just keep your answers memorable. My first car? Why, it was a "Camper Van Beethoven Freaking Rules".
- ▶ **SCRUB YOUR ONLINE PRESENCE** One of the easiest ways to hack into an account is through your email and billing address information. Sites like Spokeo and WhitePages.com offer opt-out mechanisms to get your information removed from their databases.
- ▶ **USE A UNIQUE, SECURE EMAIL ADDRESS FOR PASSWORD RECOVERIES** If a hacker knows where your password reset goes, that's a line of attack. So create a special account you never use for communications. And make sure to choose a username that isn't tied to your name – such as m***n@wired.co.uk – so it can't be easily guessed.

CloudFlare. They wanted to get into his Google Apps account, but it was protected by two-factor – so the hackers hit his AT&T mobile-phone account. As it turns out, AT&T uses US Social Security numbers essentially as an over-the-phone password. Give the carrier those nine digits – or even just the last four – along with the name, phone number and billing address on an account and it lets anyone add a forwarding number to any account in its system. And getting a Social Security number (SSN) these days is simple: they're sold openly online.

Prince's hackers used the SSN to add a forwarding number to his AT&T service, and then made a password-reset request with Google. So when the automated call came in, it was forwarded to them – *Voilà!* Prince's account was theirs, with just a little extra effort.

CARELESSNESS, IT TURNS OUT, IS THE BIGGEST SECURITY RISK OF ALL

Despite the scale of the password crisis, there isn't yet a replacement. What we can say is that access to our data can no longer hinge on secrets. The internet doesn't do secrets. Everyone is a few clicks away from knowing everything.

Instead, our new system will need to hinge on who we are and what we do: where we go and when, how we act when we're there. And each account will need to cue off many such pieces of information, not just one or two.

This last point is crucial. Two factors should be a bare minimum. Think about it: when you see a man on the street and think it might be your friend, you don't ask for his ID. Instead, you look at a combination of signals. He has a new haircut, but does his voice sound the same? Is he in a place he's likely to be? If many points don't match, you might not believe his ID; you'd just assume it was fake.

The future of online identity verification may include passwords, but it will no longer be a password-based system. The password will be just one token. Jeremy Grant of the US Department of Commerce calls this an identity ecosystem.

What about biometrics? Could a fingerprint reader or iris scanner be what passwords used to be: a single-factor solution, an instant verification? They have two inherent problems. First, the infrastructure to support them doesn't exist, a chicken-or-egg issue that almost always spells death for a new technology. Because fingerprint readers and iris scanners are expensive and buggy, no one uses them; because no one uses them, they never become cheaper or better.

The second, bigger problem is also the Achilles' heel of any one-factor system: a fingerprint or iris scan is a single piece of data, and single pieces of data will be stolen. Dirk Balfanz, a software engineer on Google's security team, points out that pass-codes and keys can be replaced, but biometrics are forever: "It's hard for me to get a new finger if my print gets lifted off a glass," he jokes. In the age of HD photography, using your face or your eye or even your fingerprint as a one-stop verification just means that anyone who can copy it can also get in.

Does that sound far-fetched? It's not. Kevin Mitnick, the fabled social engineer who spent five years in prison for his hacking heroics, now runs his own security company, which gets paid to break into systems and then tell the owners how it was done. In one recent exploit, the client was using voice authentication. To get in, you had to recite a series of randomly generated numbers, and both the sequence and the speaker's voice had to match. Mitnick called his client and recorded their conversation, tricking him into using the numbers zero through nine in conversation, which he then used to trick the system. Simple.

None of this is to say that biometrics won't play a crucial role in future security systems. Devices might require a biometric confirmation to use them, and they will help to identify you: your computer or a remote website you're trying to access will confirm a particular device – verifying something you are and something you have. But if you're logging in to your bank account from an unlikely place – say, Lagos, Nigeria – then you may have to go through a few more steps. Maybe you'll have to speak a phrase into the mic and match your voiceprint. Maybe your phone's camera snaps a picture of your face and sends it to three friends, one of whom has to confirm your identity before you can proceed.

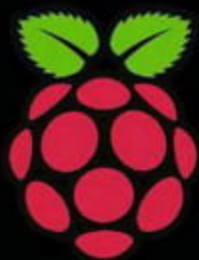
In many ways, our data providers will learn to think somewhat like credit-card companies do today: monitoring patterns to flag anomalies. "A lot of what you'll see is that sort of risk analytics," Grant says. "Providers will be able to see where you're logging in from, what kind of operating system you're using."

Google is already pushing in this direction, examining each login and how it relates to the previous one in terms of location, device and other signals the company won't disclose. If it sees something aberrant, it will force a user to answer questions about the account. "If you can't pass those questions," Smetters says, "we'll tell you to change your password – because you've been owned."

The way forward is real-identity verification: to allow our movements and metrics to be tracked and tied to our actual identity. We are not going to retreat from the cloud, so we need a system that makes use of what the cloud already knows: who we are.

That shift will involve significant investment and inconvenience, and it will likely make privacy advocates deeply wary. But times have changed. We've entrusted everything we have to a broken system. The first step is to acknowledge that fact. The second is to fix it. ■

Mat Honan is a senior writer for the US edition of WIRED



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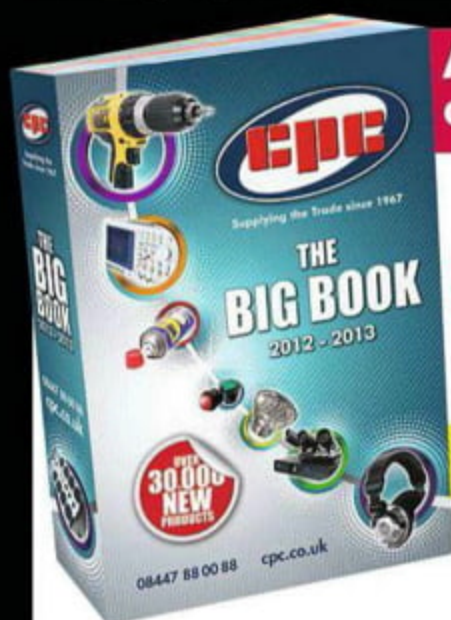
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BEST

LAB RESULTS

THIS MONTH: 01.13

- CODING COURSES
- THERMAL BASE LAYERS
- COMPACT CAMERAS

EDITED BY

JIM HILL

COSY TECH

Can base layers stand the heat - and the -6°C cold - in our thermals roundup?

36°C



16°C

SPOT: 33.7°C

Taken using a FLIR E40BX
thermal-imaging camera

CRACKING THE CODE

We rate the online schools that claim they can teach anyone programming




```
ums.filter(function(a) {return a.model});
```

```
umsToRender);
```

```
g){
```

WHAT WE LEARNED

	TUTS+	SCHOOL OF WEBCRAFT	CODECADEMY	TREEHOUSE	CODE SCHOOL
IN-BROWSER CODING	No	No	Yes	Yes	Yes
VIDEOS	Yes	No	No	Yes	Yes
QUIZZES	Yes	No	No	Yes	No
DOWN- LOADABLE CONTENT	Yes	No	No	Yes	Yes
USER- GENERATED COURSES	No	Yes	Yes	No	No

HOW WE RATE 1. A complete failure in every way 2. Barely functional – don't buy it 3. Serious flaws – buy with caution 4. Downsides outweigh upsides 5. Recommended, with reservations 6. A solid product with some issues 7. Very good, but not quite great 8. Excellent, with only a few niggles 9. Nearly flawless – buy it now 10. Metaphysical product perfection



MOZILLA SCHOOL OF WEBCRAFT

Built on the Peer 2 Peer University platform, the Mozilla courses feel too much like a series of wiki documents to compete with the other sites on test. Most challenges are user-generated, and the quality of courses can vary widely. A useful Mentorship

scheme helps coding newbies connect with advanced students, and the community is active in discussing common issues – but it can take so long to wade through cries for help that you're better off googling for an answer instead. **WIRED:** Multi-lingual **TIRED:** Tough to use **Free** p2pu.org/webcraft

CODECADEMY

There are no videos here, but in practice this gives Codecademy a more direct user interface. Detailed, quick-fire lessons sit next to a text editor, which auto-formats common characters such as quote marks and brackets to make coding a breeze. It's the most accessible platform in the group, and makes a point of comparing techniques to real-world examples, so you can understand where to apply them. **WIRED:** Paced learning **TIRED:** Too good to be free forever?

Free codecademy.com

Codecademy

TREEHOUSE

Design your own curriculum by checking off topics you want to tackle, then earn badges as you complete stages. The video courses are well produced and show plenty of code in action before throwing you in to a live text editor. Unfortunately, it's slow to check your work, and the frog mascot and childish humour are a pain. But it has plenty of great content and, unlike other sites, it covers iOS coding. **WIRED:** Feels polished **TIRED:** Annoying frog **Free** teamtreehouse.com

HOW WE TESTED

Our apprentice coder, who has limited experience of computer programming, took five online courses to find out how much and how quickly he could learn. Assessing the site's multimedia content and in-browser text editors he considered ease of use, live feedback and responsiveness.

CODE SCHOOL

These courses run for five levels, each with a 10-15 minute video, followed by a series of in-browser code challenges. The fast presentation style could be more suited to those with intermediate experience, and you'll need to hit pause if you don't want to miss crucial lines of code. The best course proved to be the simple, text-based "Try Ruby", with its chatty Codecademy style and charming hand-drawn art. **WIRED:** Cheat sheets **TIRED:** Sound effects **Free** codeschool.com

code school

BASE-LAYER BASICS

	ICEBREAKER	BAM	HAGLÖFS	HANSEN	BERGHAUS
MODEL	Men's Bodyfit 200 Mondo zip-top	Men's leggings	Active merino Q zip-top	Dry Revolution women's pants	Women's active thermal zip-top
FABRIC	100% merino wool	70% bamboo, 26% cotton, 4% lycra	100% merino wool	97% polypropylene, 3% elastane	50% hyactive, 38% wool, 12% polyamide
WEIGHT	233 grams	228 grams	180 grams	91 grams	235 grams
TEMPERATURE BESIDE SKIN	26°C	29°C	27°C	29°C	28.5°C
COLOURS	Black	Black	Crimson/black	Mauve/black	Black, grey or blue



ICEBREAKER MEN'S BODYFIT 200 MONDO ZIP

This 100 per cent merino wool, body-hugging zip-neck from New Zealand is made from a mid-weight 200g/m² yarn suited to alpine adventures. Fine-threaded merino has unparalleled thermal properties and controls moisture by absorbing it rather than wicking it away. For some people,

wool will always feel a little itchy, and its retention of moisture could make this top susceptible to mould or mildew if you forget to dry it out properly.

WIRED Superb warmth; eco-friendly
TIRED Possible itchiness; inferior durability

£70 icebreaker.com

BAM MEN'S LEGGINGS

Moisture-wicking, antibacterial, anti-static and UV protective, bamboo makes an ideal fabric. It has a smooth microstructure that lacks the itchiness of merino and offers good thermal properties. Durability and stretch are enhanced with the addition of cotton and Lycra. Drying times are the slowest in the group.

WIRED Soft as silk; lightweight; affordable

TIRED Slow to dry; unexciting design

£28 bamboooclothing.co.uk



HAGLÖFS ACTIVES MERINO Q ZIP

The fine fibres of pure, mulesing-free Turkish merino wool create a thin fabric with a high warmth-to-weight ratio. A natural fibre, its breathability prevents odour and overheating, and offset seams are less likely to chafe. Although we didn't need to wash it, it is machine-safe.

WIRED Soft and stretchy for comfort; warm and breathable
TIRED Expensive; takes longer to dry

£90
cotswoodoutdoor.com

HOW WE TESTED

To assess heat retention, we hired a FLIR E40bx camera from thermal-camera.co.uk and went to London's ICEBAR. After ten minutes at -6°C, we photographed the testers and compared results with images taken earlier at room temperature. Outdoor enthusiasts Adrian Justins and Susannah Parker also hiked in the gear to gauge comfort and style.



HELLY HANSEN DRY REVOLUTION WOMEN'S PANTS

These are seamless, fast-drying, skintight, very comfortable, non-chafing leggings that weigh just 125g/m². Soft waist- and ankle-bands hold heat in without pinching. Taller women might find them a bit short, but they fit well and retained heat fairly effectively in ICEBAR. **WIRED** Seamless; tight, soft openings; quick-drying
TIRED Not high enough for taller women; the pants may slide down

£45 hellyhansen.com



We used the FLIR E40bx camera, which weighs 825 grams and detects temperatures as low as -120°C

HEAT SEEKERS

Basal layers tested for style, comfort and performance

BERGHAUS WOMEN'S ACTIVE THERMAL ZIP-TOP

Made chiefly from polyester, the channelled yarn isn't the softest on skin, but it wicks moisture, and a silver-ion coating curbs odour. The zip provides adjustable ventilation but it creates a poor fit across the neck and

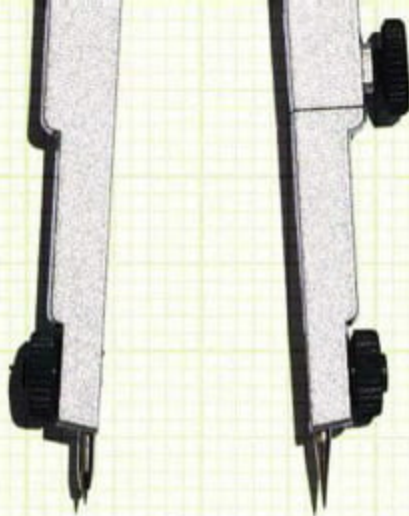
shoulders, and allows some heat loss. A close body fit holds heat, and drying time is good for its $250\text{g}/\text{m}^2$ weight.

WIRED Stays warm; long sleeves; effective perspiration control

TIRED Zip flops down; not the softest feeling



£50 berghaus.com



SMALL & MIGHTY

Compact in size, but big on features, these cameras have pro-user ambitions

OLYMPUS STYLUS XZ-2

With a dual-function control ring around the lens, a touchscreen LCD, and f/1.8-2.5 maximum aperture, the XZ-2 is a high-end compact that impresses. The ability to use f/2.5 at the 112mm (equivalent) end of the zoom is useful, and the

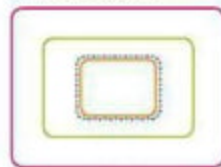
bokeh effect is fantastic. Although the camera body is chunky – partly on account of the tilt-angle screen – its fairly small 2.5 x 4.3cm illuminated sensor is very capable.

WIRED Dual-function lens ring; touchscreen

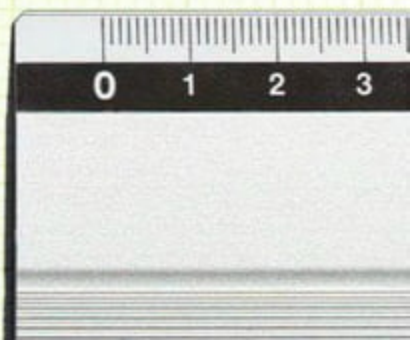
TIRED Bulky form factor

£479 olympus.co.uk

SENSOR SIZE



- CANON 262MM²
- SONY 116MM²
- SAMSUNG 43.30MM²
- OLYMPUS 43.30MM²
- PANASONIC 34.2MM²



**SONY RX100**

It's hard to fault Sony's latest – its 2.5cm sensor is the second-largest on test, but was able to resolve the most detailed images and performed well at higher sensitivities. The camera is pocket-friendly in size, but

at the expense of limiting the controls. The lack of a hot-shoe for adding optional accessories also makes it feel more like a point-and-shoot than a serious camera.

WIRED Great images
TIRED No viewfinder

★★★★★
£499 sony.co.uk

CANON POWER-SHOT G1 X

Canon's chunky G1 X is the biggest model on test, but for good reason: it packs the largest sensor size here, giving superb image quality. However, it's also the most expensive camera in our group, soaring past the £500 mark. Although

ahead in price, the G1 X lags behind the competition in performance speed, such as snapping to focus. It can take stunning photos, but this pricey contender isn't the best all-rounder in the group.

WIRED Image quality
TIRED Big and bulky

★★★★★
£569 canon.co.uk

**PANASONIC LUMIX LX7**

Sturdy in the hand, the LX7 is elegantly designed and the abundance of controls will please professional users. The f/1.4-2.3 maximum aperture is the brightest of the bunch and helps keep those higher sensitivity shots at bay – probably for the best because, despite its good points, mid-high ISO shots were the poorest on test.

WIRED Fast to focus
TIRED No touchscreen

★★★★★
£399 panasonic.co.uk

**SAMSUNG EX2F**

Samsung's secret weapon comes loaded with Wi-Fi connectivity that, while fun, is a bit of a battery-drainer. It's the optics that excite more. The f/1.4 maximum aperture is teamed with fast autofocus and a back-side illuminated sensor that, although the joint-second smallest on test, is able to deliver sharp and detailed images beyond many of its

rivals. However, the 24-80mm (equivalent) zoom range is the most limited of the five on test, and it can feel rather restrictive. Close-up focus isn't great either, and autofocus can be inconsistent. Battery life is also a bit short – but it's still well worth a look.

WIRED Wi-Fi
TIRED Flat battery

★★★★★
£430 samsung.com/uk

HOW WE TESTED

Photography expert, Mike Lowe, gauged the cameras' abilities in daylight, low light and on location. Image quality and resolved detail were measured in the lab using an ISO-standard resolution chart.

FOCUS GROUP

	OLYMPUS STYLUS XZ-2	SONY RX100	SAMSUNG EX2F	CANON G1 X	PANASONIC LUMIX LX7
SENSOR	12-megapixel 2.5 x 4.3cm BSI CMOS	20.2-megapixel 2.5cm CMOS	12.4-megapixel 2.5 x 4.3cm BSI CMOS	14.3-megapixel 3.8cm CMOS	10.1-megapixel 2.5 x 4.3cm CMOS
LENS	28-112mm f/1.8-2.5 (W-T) (equiv.) / 4x optical zoom	28-100mm f/1.8-4.9 (W-T) (equiv.) / 3.6x optical zoom	24-80mm f/1.4-2.7 (equiv.) / 3.3x optical zoom	28-112mm f/2.8-5.8 (W-T) (equiv.) / 4x optical zoom	24-90mm f/1.4-2.3 (W-T) (equiv.) / 3.8x optical zoom
SENSITIVITY	ISO 100-12, 800	ISO 100-25, 600	ISO 80-12, 800	ISO 100-12, 800	ISO 800-6400 (12,800 pixel-mix readout)
SCREEN	3-inch, 921k-dot LCD mounted on tilt- angle bracket	3-inch, 1,228k-dot (four-colour WVGA) LCD	3-inch, 614k-dot OLED mounted on vari-angle bracket	3-inch, 921k-dot LCD mounted on vari-angle bracket	3-inch, 921k-dot LCD
SIZE & WEIGHT	102 x 59 x 36mm; 240g (inc. card and battery)	102 x 59 x 36mm; 240g (inc. card and battery)	112.1 x 62.4 x 27.55mm; 300g (inc. card or battery)	116.7 x 80.5 x 64.7mm; 534g (inc. card and battery)	110.5 x 67.1 x 45.6mm; 298g (inc. card and battery)

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podcast – now available in both audio-only and video formats...

Awards this month:

Congratulations to our editor, David Rowan, who won Editor
of the Year: Special Interest Magazine at the BSME awards.
Of course, he couldn't do much of anything without the vital
assistance of his team, as evidenced below. You're welcome.



Overheard this month:

"Oh no, I'm absolutely great at being firm. It's being nice
and friendly that I have a problem with."
"I am being paid to colour things in. Literally."
"That's not exciting – it's just a white box."
"It's not just a white box. It's, like, four white boxes."
"I'm so tired, I have highlighter ink on my face."
"As spectrometer instructions go, I think they're a bit brief."

Extra credit:

Thanks to: Niche London (nichelondon.com) for supplying
the "Zimbra" stool for our Conference report shots (p55).
Makeup for Margaret Atwood (p7): Kelly Meredith

Beer:

To celebrate the 100th episode of the WIRED podcast, the
Meantime Brewing Company created a special batch of beer just
for us. But what to call it? "Swiggs Boson" won the day, though
"Tricerahops" and "Cosmic Unicorn" were also close contenders.
The next level: a WIRED cocktail. Suggestions very welcome.

Headline rejected this month:

"Screen wipes"

Contracts:

Ferran Adrià's contract for his star turn at WIRED2012 stipulated
that the celebrity chef will not be expected to cook.

Sources for the WIRED Index (p40):

[1, 2] nasa.gov
[3] abclocal.go.com
[4, 5] cryosinternational.com
[6] bloomberg.com
[7, 8] ncbi.nlm.nih.gov/pubmed/18394539
[9] wordpress.bluefinlabs.com/blog

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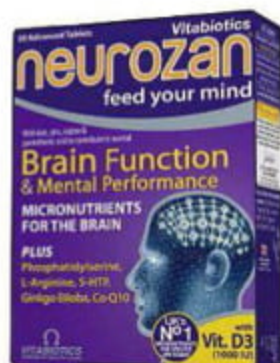
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